

HP 75000 SERIES C

C-Size VXIbus Systems

Installation and Getting Started Guide



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Quick Installation Chart

Introduction

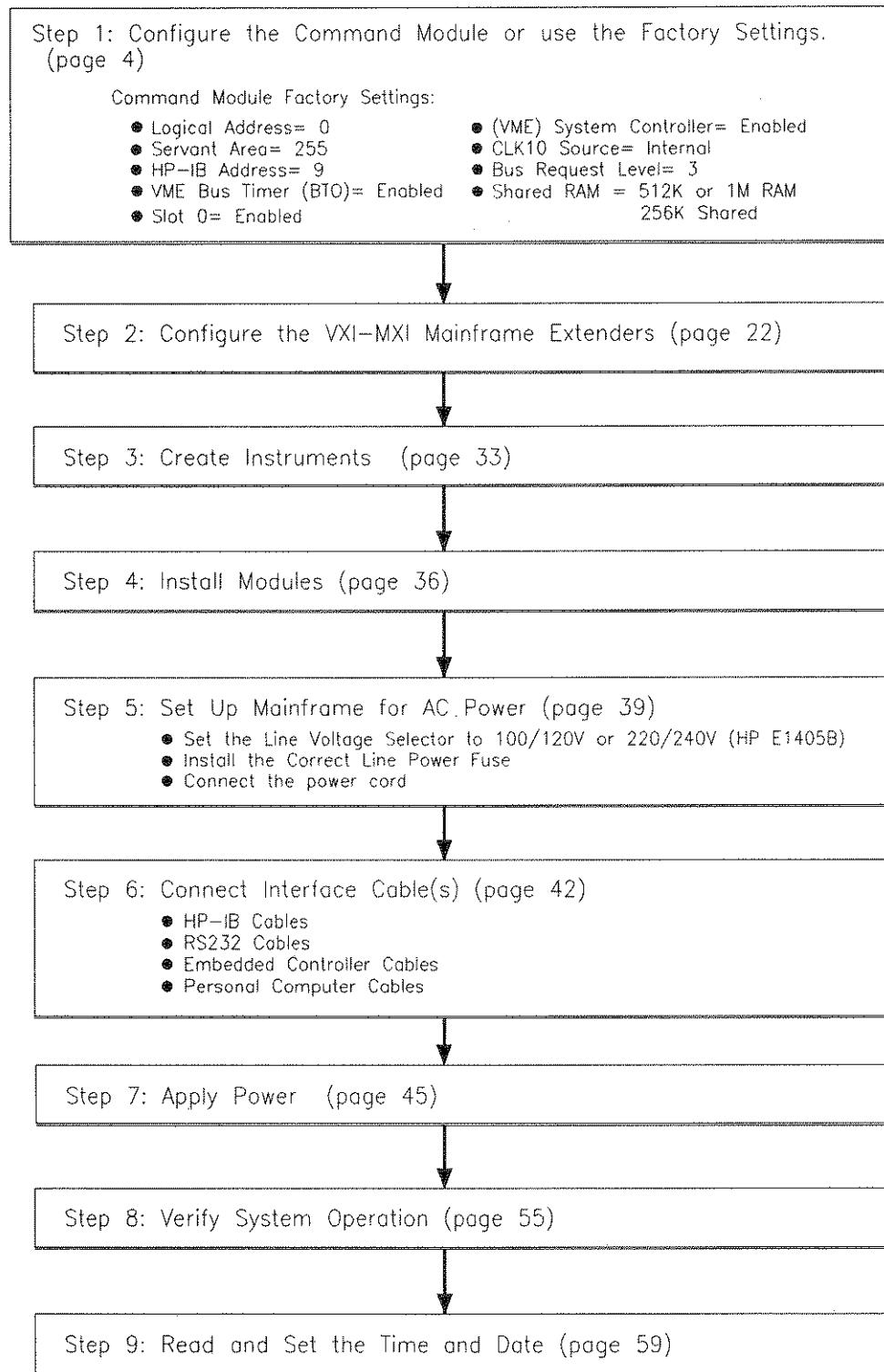
The chart in Figure 1 summarizes the steps involved in setting up and installing an HP 75000 Series C VXIbus system. The steps in the chart are the same as those described, in greater detail, in the Installation Guide. If you have installed a Series C system before, the chart may be all you need to perform a successful installation. If you have no previous installation experience, we recommend you use the chart as a guideline to installation and refer to the Installation Guide whenever you need more information on a particular step.

NOTE

By using the factory settings on the Command Module and plug-in modules, you can avoid most of the configuration details discussed in the Installation Guide. Although this may not provide the flexibility of a custom configuration, it is adequate for many installations. You may also want to use the chart as a starting point to get your system up and running and then make specific configuration modifications as described in the Installation Guide.

WARNING

SHOCK HAZARD. Only service-trained personnel who are aware of the hazards involved should install, remove, or configure the system. Before you perform any procedures, disconnect AC power and field wiring from the mainframe.



E1406A Fig1

Figure 1. Quick Installation Chart

Detailed Installation Procedures

The procedures on the following pages show the details involved with setting up and installing an HP 75000 Series C VXIbus system. A system usually consists of the following:

- HP E1401A or E1400B Mainframe
- HP E1406A or E1405B Command Module
- VXIbus plug-in modules
- VXI-MXI mainframe extender modules
- External or embedded (installed in the card cage) controller

WARNING

SHOCK HAZARD. Only service-trained personnel who are aware of the hazards involved should install, remove, or configure the system. Before you perform any procedures in this guide, disconnect AC power and field wiring from the mainframe.

CAUTION

STATIC ELECTRICITY. Static electricity is a major cause of component failure. To prevent damage to the electrical components in the mainframe and plug-in modules, observe anti-static techniques whenever handling a module.

STEP 1: Configure the Command Module

In systems controlled by an external controller (computer), Step 1 in setting up your system is to configure the HP E1406/HP E1405 Command Module. This includes:

- setting the Command Module as the resource manager and slot 0 device
- setting the Command Module servant area
- setting the Command Module primary HP-IB address

The following table shows how the Command Module is configured at the factory:

Switch	Setting
Logical Address	0
Servant Area	255
HP-IB Address	9
VME Bus Timer (BTO)	Enabled
Slot 0	Enabled
(VME) System Controller	Enabled
CLK10 Source	Internal
Bus Request Level	3
Shared RAM	512K or 1M RAM, 256K Shared

NOTE

This section describes system configurations based on Command Module switch settings. The configurations can be overridden by configuration tables stored in the Command Module. The tables are discussed in the HP E1406 User's Manual.

NOTE

The Flash ROMS switch must be set to the 'Run' position when the HP E1406A is configured and turned on.

What are the Resource Manager and Slot 0 Functions?

Every VXIbus system must have a module(s) which provides the system's resource manager and slot 0 requirements.

At power-on, the **resource manager** function is started. The purpose of the **resource manager** is to:

- identify all plug-in modules installed in the C-size mainframe
- set commander/servant hierarchies whereby one or more plug-in modules "control" other plug-in modules
- perform A24/A32 address mapping so that modules requiring additional addressing can receive it
- allocate interrupt lines to manage communication between interrupt handler modules and interrupter modules
- start system operation

Once the power-on sequence is completed and the system is started, the resource manager is no longer used.

Slot 0 functionality is used during operation. The purpose of **Slot 0** is to:

- locate where modules are installed in the mainframe.
- manage (arbitrate) data flow across the VXIbus backplane busses
- provide the system clock (SYSCLK - 16 MHz)

In VXIbus systems using an external controller, the **Command Module** should be configured as the resource manager and slot 0 device.

NOTE

Refer to "Alternate Command Module Configurations" on page 20 if you are:

- *Using more than one Command Module.*
- *Using the Command Module as the resource manager only.*
- *Using the Command Module as the slot 0 device only.*

The section, "Using the Command Module with an Embedded controller" (page 15), explains how the **Command Module** is used when it is not the resource manager or slot 0 device.

What is a Logical Address?

Every device in a VXIbus system has a unique logical address. In HP VXIbus systems, the logical address is used to:

- Create instruments.
- Establish servant areas.
- Derive secondary HP-IB addresses that are used to program instruments from the HP-IB.
- Determine the base address of the device's registers in A16 address space.
- Set the device as the system resource manager (HP E1406 Command Module).

Setting the Command Module as the Resource Manager

The resource manager function in modules with this capability is activated by setting the logical address to 0. The Command Module factory-set logical address is 0. The location of the logical address switch is shown in Figure 2.

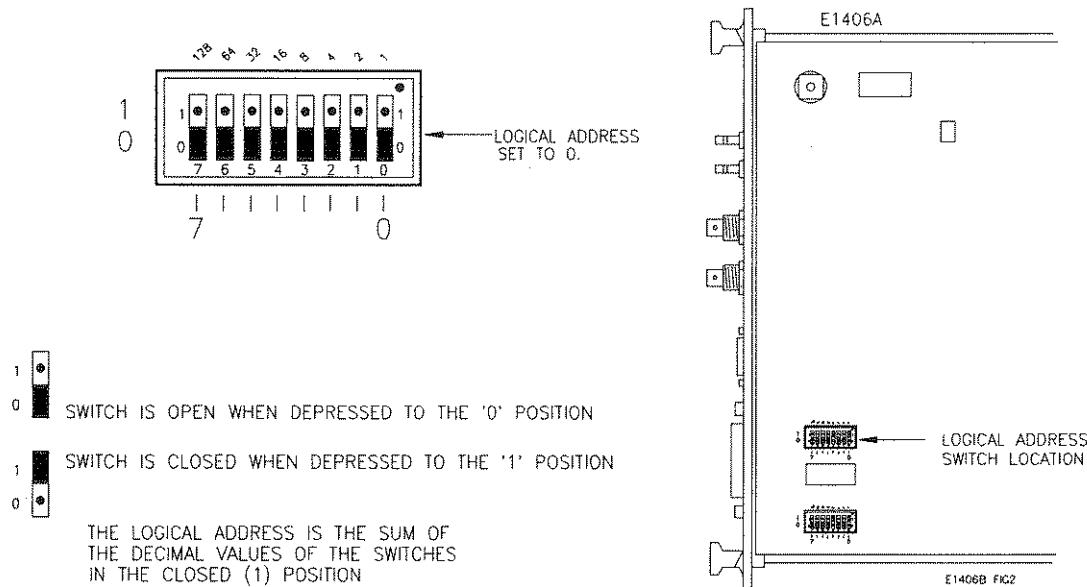


Figure 2. Setting the Command Module's Logical Address

Setting the Command Module as the Slot 0 Device

To set the Command Module as the system's slot 0 device, set the module's Slot 0 and (VME) System Controller (bus arbiter) switches to the "Enable" position. The switch locations are shown in Figure 3. The Command Module must also be installed in mainframe slot 0 (see Step 4: Install Modules).

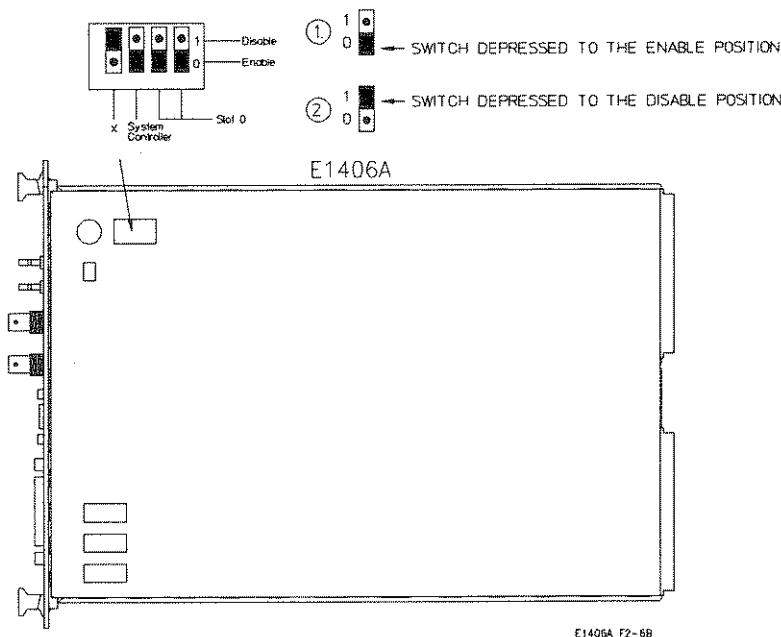


Figure 3. The System Controller Mode and Slot 0 Enable/Disable

NOTE

The 'Slot 0' and '(VME) System Controller' switches must be set to the "Disable" position when the Command Module is installed in a slot other than slot 0. See "Alternate Command Module Configurations" on page 20.

Setting the 10 MHz Clock Source

One of the slot 0 resources supplied by the Command Module is the 10 MHz system clock: CLK10. This clock is distributed to every slot along the VXIbus backplane. The clock may be an internal signal generated by the Command Module, or an external signal supplied to the backplane via the SMB faceplate connector on the Command Module.

CLK10 Source Guidelines

- The CLK10 source is set to "Internal" at the factory.
- The initial accuracy of the internal 10 MHz ECL clock is ± 50 ppm. The duty cycle is $50\% \pm 5\%$.
- The CLK10 source can be routed to external devices using the 'Clk Out' SMB connector.
- If an external clock is selected, the signal is input to the Command Module through the 'Clk In' SMB connector.
- Disabling the slot 0 and (VME) System Controller functions removes the internal system clock or external clock from the VXIbus backplane. However, the clock from either source is still present at the 'Clk Out' SMB connector.

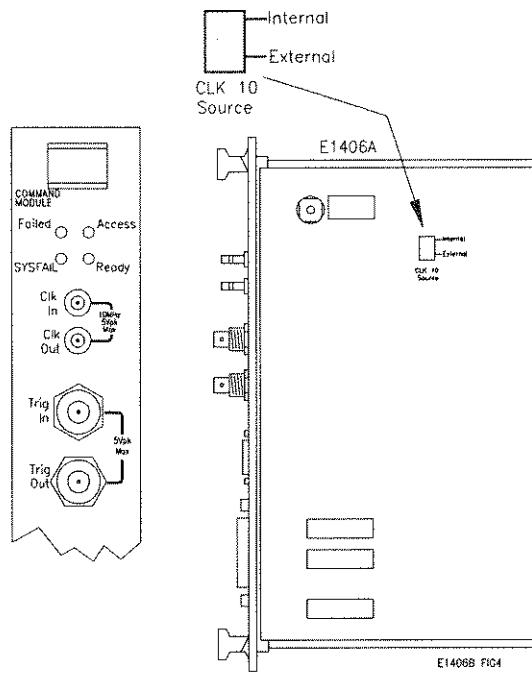


Figure 4. Selecting the Internal or External System Clock

What is the Bus Request Level?

The bus request level is a priority at which the Command Module can request the use of the Data Transfer Bus.

Bus Request Level Guidelines

- There are four bus request lines (0 - 3) from which one may be selected. Bus request line 3 has the highest priority, bus request line 0 has the lowest priority.
- The Command Module's bus request level switch is set to 3 at the factory. In most VXIbus systems and configurations, it is not necessary to change this setting.

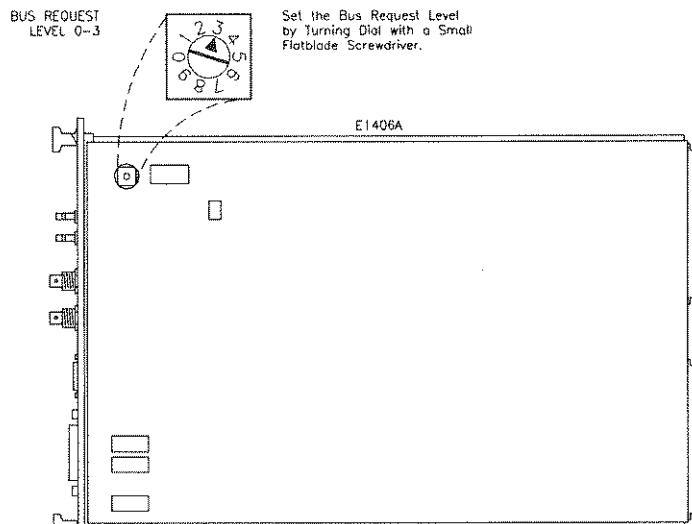


Figure 5. Setting the Command Module's Bus Request Level

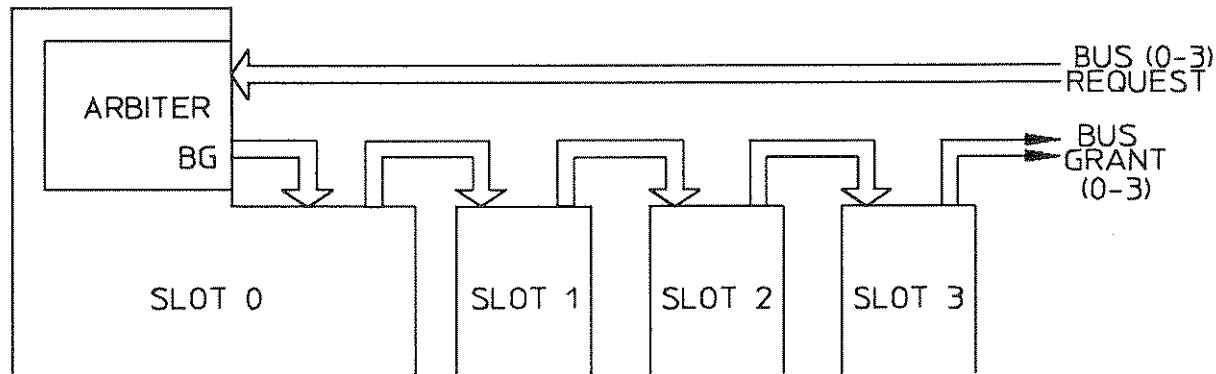
Data Transfer Bus Arbitration

In a VXIbus system, the Data Transfer Bus (DTB) is used for addressing and data transfer. As a result, many instruments in a typical VXIbus system request the use of the bus. Arbitration of the DTB is done by the slot 0 module (see NOTE on page 10), using a Fair Requester protocol (Figure 6). This protocol requires that once a module has requested and has been granted the bus, it may not request the bus again until 30 ns after the bus request line is released. Although the bus grant signal is daisy-chained from module to module, the 30 ns delay prevents a module in a lower slot from continually being granted the bus. The Command Module, even though it may be the slot 0 module, must also request the bus in the same manner as any other module.

This form of arbitration occurs on any bus request line (0 - 3) selected. However, because of the bus request line priority, a module requesting the DTB from bus request line 3 would be granted the DTB before a module requesting the bus from request line 0, 1, or 2.

NOTE

In multiple mainframe systems, (data transfer) bus arbitration must be provided by the VXI-MXI mainframe extender modules and not by the Command Module. See "Step 2: Configure the VXI-MXI Mainframe Extenders" for more information.



(ME10) E1405:F.2.9

Figure 6. Data Transfer Bus (Fair Requester Arbitration)

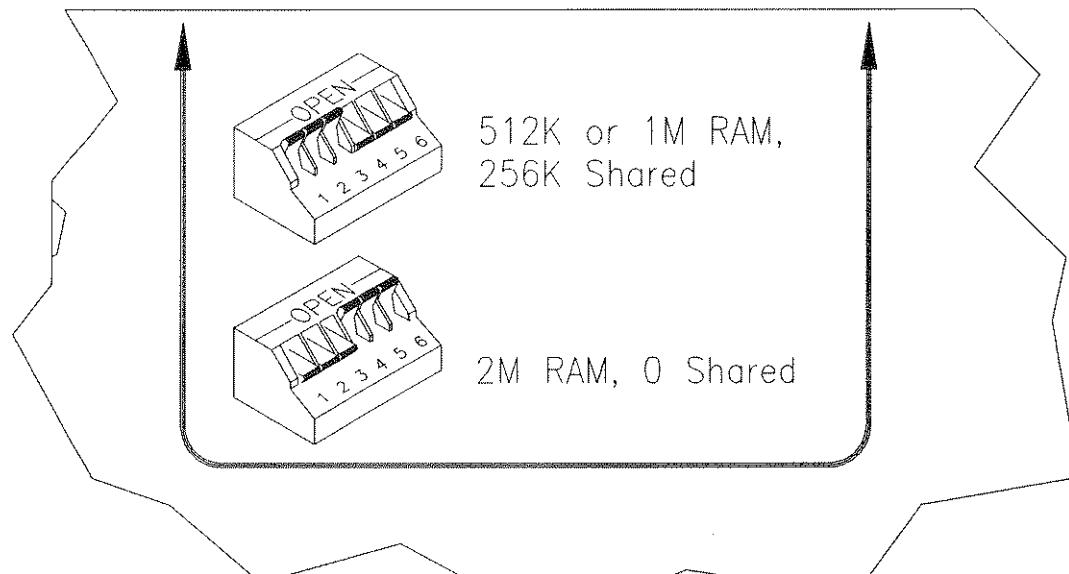
Configuring Command Module Memory

The standard E1406A comes equipped with 1.25 Mbytes of flash ROM, 512 Kbytes of non-volatile RAM, and 256 Kbytes of shared RAM. The module's memory configuration and usage is shown in Figure 7.

Command Module Memory	Contents
<u>Flash ROM</u>	- operating system
1.25 Mbytes *	- device drivers
1.75 Mbytes	
<u>Non-Volatile RAM</u>	
512 Kbytes *	- device drivers
1 Mbytes	- IBASIC programs and data, RAM disk
2 Mbytes	- system parameters
<u>Shared RAM</u>	
256 Kbytes*	- available to VXIbus system
none	

* = standard configuration

Figure 7. HP E1406A Memory Configuration



E1406 fig8

Figure 8. Allocating Shared RAM

Allocating Shared RAM

When expanded memory option 010 is installed, the switch shown in Figure 8 is used to set one of the following configurations:

- 1 Mbyte non-volatile RAM and 256 Kbytes of shared RAM
- 2 Mbytes non-volatile RAM and 0 bytes of shared RAM

When option 010 is factory-installed, the switch is set for 1 Mbytes/256 Kbytes. If the Command Module contains standard memory only, setting the switch for 2 Mbytes disables the shared memory. The memory (256 Kbytes) is **not** available as non-volatile memory.

What is the Servant Area?

In a VXIbus system, modules in the "servant area" of another module are servants to that module (the commander). The commander module controls servant modules by translating Standard Commands for Programmable Instruments (SCPI) commands for register-based modules, or by serving as the HP-IB interface to message-based modules. The concept of the servant area and commander/servant hierarchies is shown in Figure 9.

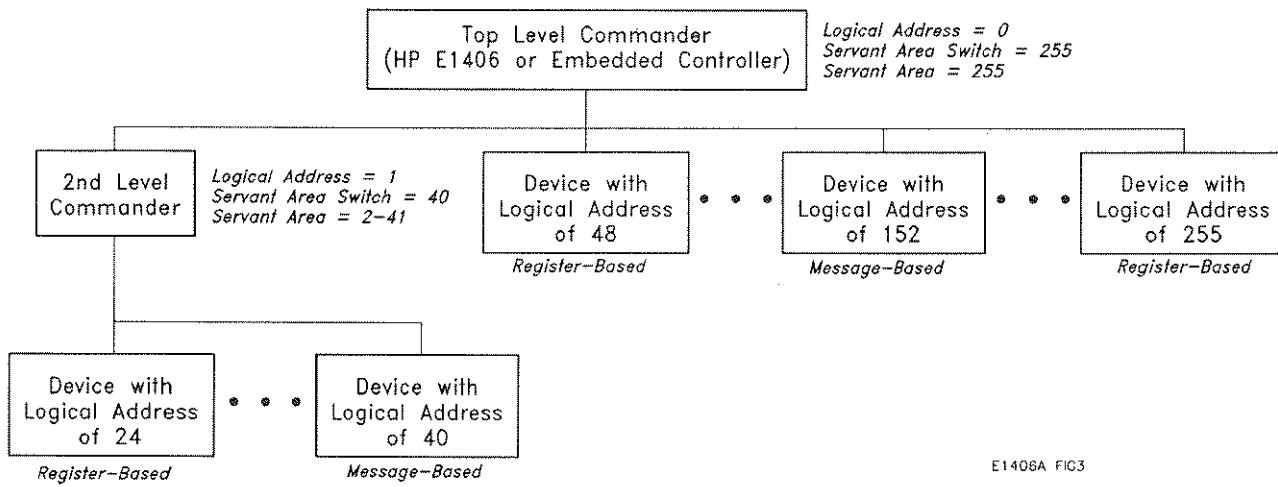


Figure 9. Commander/Servant Hierarchy

In addition to setting the HP E1406/05 Command Module as the resource manager, the logical address is used with the servant area switch setting to determine the servant area of the Command Module:

Servant area = (logical address + 1) through (logical address + servant area switch setting)

Command Module Servant Area Guidelines

- The Command Module should be the commander for the system's Hewlett-Packard register-based modules. This enables HP's register-based modules to be programmed with SCPI commands via the Command Module. The Command Module should also be the commander for the system's message-based modules (if no embedded controller is present) so that the Command Module will serve as the HP-IB interface to those modules.
- The Command Module will always be the commander of Instrument BASIC (IBASIC) whether or not IBASIC is in the Command Module's servant area.
- A commander may be a servant to another commander (forming a hierarchical system). Servants in the servant area of the "lower-level" commander are controlled by the lower-level commander.

When the Command Module is the resource manager (logical address = 0), its servant area should be set to 255. Thus, the Command Module will be the (top level) commander for all modules with logical addresses between 1 and 255.

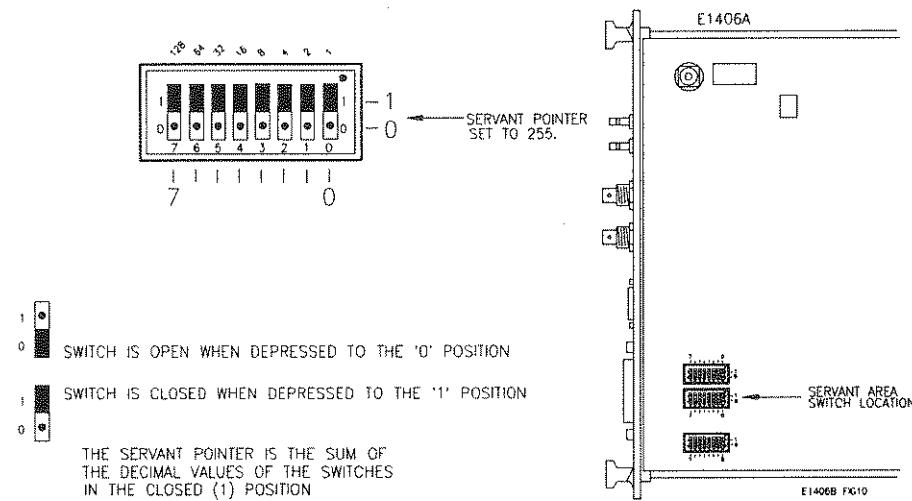


Figure 10. Setting the Command Module's Servant Area

What is the Command Module Primary HP-IB Address?

HP-IB is Hewlett-Packard's implementation of ANSI/IEEE Standard 488.1-1978 "IEEE Standard Digital Interface for Programmable Instrumentation". The primary HP-IB address identifies the HP-IB port on the Command Module. This address is combined with the Command Module's secondary HP-IB address (always 00), and with the external controller's (HP-IB) interface select code (typically 7 for HP controllers), to form the Command Module's complete HP-IB address. See "Sending Commands" on page 55 for more information.

Command Module Primary HP-IB Address Guidelines

- The Command Module has a factory-set HP-IB address of 9. If there is only one Command Module (i.e. only one HP-IB port) in your VXIbus mainframe, then it is not necessary to change this setting. When there is more than one Command Module in the mainframe, the modules must have unique primary HP-IB addresses if they are connected to the same controller HP-IB interface card.
- Valid primary HP-IB addresses are 0 to 30.

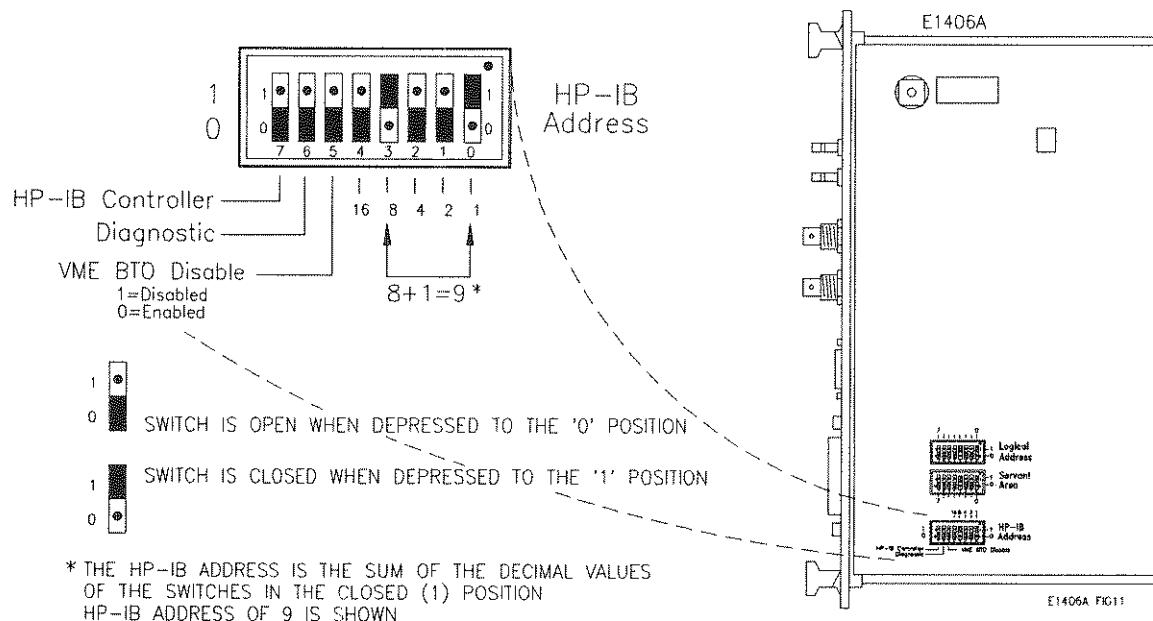


Figure 11. Setting the Primary HP-IB Address

NOTE

Setting the "Controller" switch to the '1' position sets the Command Module as the HP-IB system controller (IBASIC applications). '0' sets the talk/listen mode. This switch should be set to '1' when IBASIC, rather than an external controller, is to be the system controller.

When the "Diagnostic" switch is set to '1', the resource manager starts the system instrument but does not start any installed devices. '0' starts the entire system.

Setting the 'VME BTO Disable' switch to '1' disables the Command Module from functioning as the Data Transfer Bus timer. This function must only be disabled when VXI-MXI mainframe extender modules are part of your VXIbus system. See "Step 2: Configure the VXI-MXI Mainframe Extenders" on page 22 for more information.

Where to go Next

If an embedded controller or VXI-MXI mainframe extender modules are not part of your system, continue with Step 3: Create Instruments.

Using the Command Module with an Embedded Controller

When an embedded controller such as the HP E1499A V/382 and an HP E1406/05 Command Module are part of your VXIbus system, you must configure the embedded controller for use with the Command Module. This includes:

- setting the embedded controller as the resource manager and slot 0 device
- setting the embedded controller's servant area
- setting the Command Module logical address and servant area
- setting the Command Module primary HP-IB address
- disabling the Command Module's slot 0 and system controller capability

NOTES

See your embedded controller's manual for information on the controller's configuration switches and for information on connecting cables and installing the controller in a Series C mainframe.

The embedded controller's operating system and associated VXI software should be previously installed and running when the VXIbus modules are added to the mainframe. This is best accomplished by first installing only the embedded controller in the Series C mainframe, applying power, and then installing the software. Refer to your controller manuals for more information on the operating system and VXI software.

In VXIbus systems containing an embedded controller and an HP E1406/05 Command Module, it is recommended that the embedded controller function as the resource manager and slot 0 device. The resource manager and slot 0 functions are described on page 5.

NOTE

Refer to "Alternate Command Module Configurations" on page 20, if you are:

- *Using more than one Command Module.*
- *Using the Command Module as the resource manager only.*
- *Using the Command Module as the slot 0 device only.*

**Embedded Controller
Servant Area
Guidelines**

The following servant area guidelines apply when an embedded controller (V/382) is used with the Command Module. Refer to the section, "What is the Servant Area?" on page 12 for more information.

- The servant area of the embedded controller is determined as:

$$\text{Servant area} = (\text{logical address} + 1) \text{ through } (\text{logical address} + \text{servant area switch setting})$$
- The embedded controller should be the commander for the system's message-based modules (including other commanders). Modules such as the HP E1406/05 Command Module should be the commander for the system's register-based modules. This enables Hewlett-Packard's register-based modules to be programmed with SCPI commands via the Command Module.

- A commander may be a servant to another commander (forming a hierarchical system). Servants in the servant area of the "lower-level" commander are controlled by the lower-level commander.
- The embedded controller's servant area should be set to 255. Thus, if the embedded controller's logical address is 0 and its servant area setting is 255, the embedded controller will be the top-level commander for all modules with logical addresses between 1 and 255.

Command Module Logical Address and Servant Area Guidelines

The following guidelines apply when the Command Module is a servant to an embedded controller.

- For the Command Module to be the commander for a register-based module, the register-based module's logical address must fall within the Command Module's servant area. The servant area of the Command Module is determined as:

$\text{Servant area} = (\text{logical address} + 1) \text{ through } (\text{logical address} + \text{servant area switch setting})$

- The Command Module has a factory-set logical address of 0 and servant area of 255. Since logical address 0 is the address of the resource manager (the embedded controller), you must change the Command Module's logical address. Recommended addresses are 1, 2, or 3, which are not instrument identifier addresses (see Step 3: Create Instruments).

The logical address plus the Command Module's servant area cannot exceed 255. Therefore, set the servant area based on the logical addresses of the register-based modules in your system (see Step 3). The Command Module's logical address and servant area switches are shown in Figure 12.

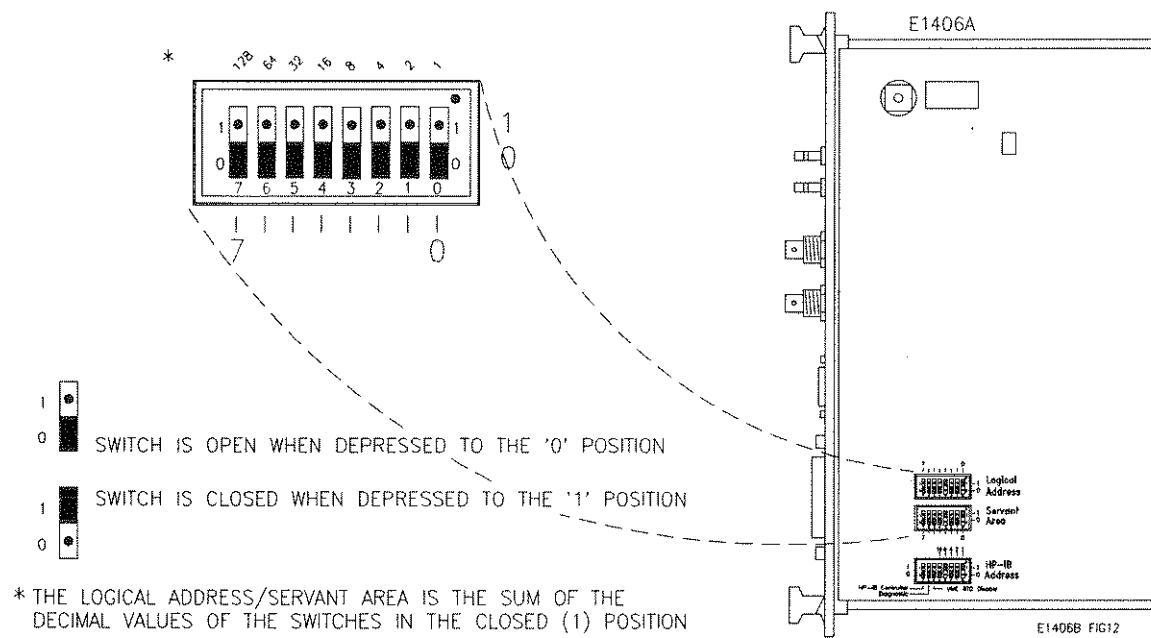


Figure 12. HP E1406A Logical Address and Servant Area Switches

Command Module Primary Address Guidelines

- The Command Module has a factory-set HP-IB address of 9. If there is only one Command Module in your mainframe, then it is not necessary to change this address. When there is more than one Command Module in the mainframe, the modules must have unique primary HP-IB addresses.
- Valid primary HP-IB addresses are 0 to 30.

NOTE

Setting the "Controller" switch to the '1' position sets the Command Module as the HP-IB system controller (IBASIC applications). '0' sets the talk/listen mode. This switch should be set to '1' when IBASIC, rather than an external controller, is to be the system controller.

When the "Diagnostic" switch is set to '1', the resource manager starts the system instrument but does not start any installed devices. '0' starts the entire system.

Setting the 'VME BTO Disable' switch to '1' disables the Command Module from functioning as the Data Transfer Bus timer. This function must only be disabled when VXI-MXI mainframe extender modules are part of your VXIbus system. See "Step 2: Configure the VXI-MXI Mainframe Extenders" on page 22 for more information.

Disabling the Command Module's Slot 0 Capability

The HP E1499A V/382 embedded controller contains the resource manager and slot 0 functionality that is also provided by the Command Module. When the Command Module is used in a system with an embedded controller, the slot 0 and VME system controller capability on the Command Module must be disabled. This is done by moving the "System Controller" and "Slot 0" switches to the "Disable" position. The location of these switches is shown in Figure 13.

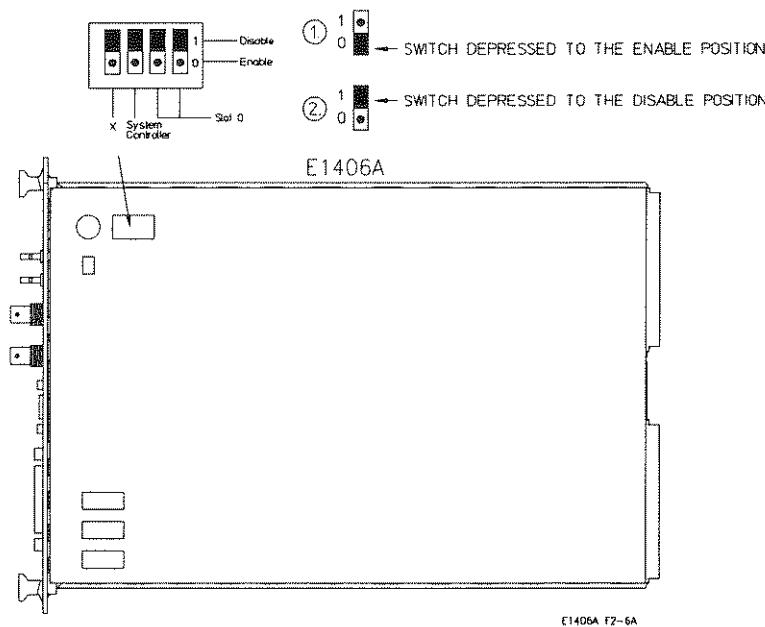


Figure 13. Command Module VME Controller and Slot 0 Disable Switches

NOTE

When the HP E1406/05 Command Module is not the slot 0 device, disregard the "Clk 10 Source" switch setting.

Bus Request Level Guidelines

The bus request level is a priority at which the Command Module can request the use of the Data Transfer Bus. See "What is the Bus Request Level?" and "Data Transfer Bus Arbitration" for more information.

- There are four bus request lines (0 - 3) from which one may be selected. Bus request line 3 has the highest priority, bus request line 0 has the lowest priority.
- The Command Module's bus request level switch is set to 3 at the factory (Figure 5). When the Command Module is used with an embedded controller, it is not necessary to change this setting.

Where to go Next

If **VXI-MXI mainframe extender modules** are not part of your system, go to Step 3: Create Instruments. Otherwise continue with Step 2: Configure VXI-MXI Mainframe Extenders.

Alternate Command Module Configurations

If the HP E1406/05 Command Module is to function **only** as the resource manager and not as the slot 0 device:

1. The Command Module must have a logical address of 0.
2. The Command Module must be installed in a slot other than slot 0.
3. The "Slot 0" and (VME) "System Controller" switches must be set to "Disable".
4. Another device must provide the system's slot 0 functions.
5. Dynamic configuration and slot identification will not be done.

If the Command Module is to function **only** as the **slot 0** device and not as the resource manager:

1. The Command Module must be installed in slot 0.
2. The Command Module must have a logical address **other** than 0.
3. The Slot 0 and System Controller switches must be set to "Enable".
4. The CLK10 source should be set to "Internal".
5. Another device must perform the resource manager function.

Multiple Command Modules

In systems where there are several Command Modules:

1. If an embedded controller is not part of your system, configure one Command Module as the resource manager and slot 0 device as described in Step 1: Configure the Command Module.
2. Set the logical addresses and servant areas of the additional Command Modules based on the logical addresses of their servant modules.
3. Each Command Module must have a unique primary HP-IB address if it is connected to the same controller HP-IB interface card.
4. Disable the "Slot 0" and (VME) "System Controller" functions on each Command Module not functioning as the resource

manager or slot 0 device; there can be only one resource manager and slot 0 device in a system.

5. Only one Command Module is required to translate SCPI commands for the system's Hewlett-Packard register-based modules - provided the register-based modules are in the Command Module's servant area, they are assigned secondary addresses (see Step 3), and the Command Module contains the instrument drivers.
6. When a Command Module is in the servant area of another Command Module, the Command Module functioning as the resource manager will report one of the following error conditions:

Error 11: INVALID INSTRUMENT ADDRESS

3, Config warning, Device driver not found

Error 11 occurs when the Command Module's logical address is not a multiple of 8. The configuration warning occurs when the logical address is a multiple of 8. In either case, the error or warning can be ignored.

7. Communication and timing between a Command Module and its servants is achieved using VXIbus backplane interrupt lines. The interrupt lines are assigned at power-on by the resource manager. The Command Module resource manager assigns interrupt line 1 to itself. The other interrupt lines are assigned to the system's programmable handlers. Unused interrupt lines are not assigned.

Hewlett-Packard's register-based modules are factory-set to interrupt line 1. Thus, for those modules which are servants to a Command Module assigned an interrupt line other than 1, the jumper must be moved to match their Command Module. Refer to the module's documentation for the jumper location. The Command Module resource manager configuration sequence on page 46 shows the interrupt line assigned.

NOTE

The HP E1499A V/382 controller resource manager assigns interrupt line 1 and all unused lines to itself.

STEP 2: Configure the VXI-MXI Mainframe Extenders

With the HP E1482A VXI-MXI mainframe extender module, multiple E1401A/E1400B mainframes are integrated into a single VXIbus system. The E1482 extends the VXIbus from mainframe to mainframe by converting VXIbus signals to and from the appropriate MXIbus signals, and transmitting them over the MXIbus cables.

This section explains how the E1482 is configured for use with the HP E1406/05 Command Module or with the HP E1499 V/382 embedded controller when either is the system's resource manager and slot 0 device.

Recommended HP E1482 VXI-MXI Extender Configuration

The recommended configuration of the VXI-MXI mainframe extender modules is listed in Table 2-1. The switch and jumper locations are found in Figure 15. Most of the factory-settings correspond to the recommended settings. For detailed information on VXI-MXI extender module configuration, refer to the HP E1482A VXI-MXI Bus Extender User's Manual.

Disabling the VMEbus Time Out

When E1482 VXI-MXI mainframe extender modules are part of your system, the modules must function as the Data Transfer Bus (DTB) timer. This means the bus timer capability of the Command Module or V/382 controller must be disabled. This is done by setting the 'VME BTO Disable' switch (Command Module) or 'VXIbus Error Timer' switch (V/382) as indicated in Figure 14. The VMEbus timer capability (VME BTO Level) of the E1482 is enabled at the factory.

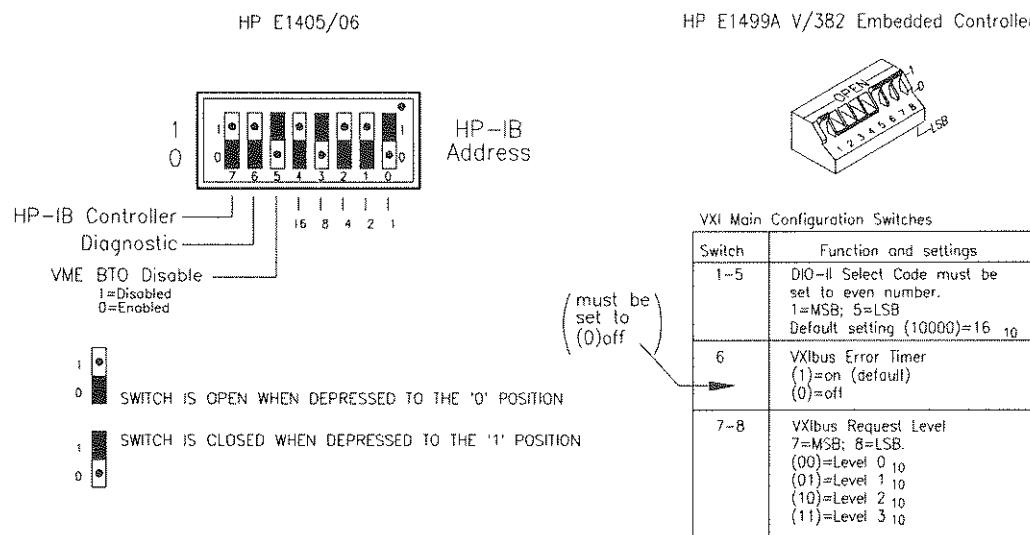


Figure 14. Disabling Data Transfer Bus Timer Capability

Table 1. HP E1482A Recommended Configuration Settings

Step	Setting	Switch/ Jumper	Root Mainframe VXI-MXI Module	Extender Mainframe VXI-MXI Module
1	Trigger Input Termination	S5	None	None
2	Ext Clk SMB	S6	Output	Output
3	MXIbus Terminating Resistor Networks	---	Installed	Remove unless last device in daisy chain
4	MXI Controller Timeout Level	W8	MXIbus timeout = 100 µs	MXIbus timeout disabled
5	VME BTO Level	W6	VMEbus timeout = 200 µs	VMEbus timeout = 100 µs
6	INTX Terminating Resistor Networks	---	Installed	Remove unless last device in daisy chain
7	MXIbus Fairness	S2	Fairness enabled	Fairness enabled
8	Interlocked Arbitration	S3	Interlocked	Interlocked
9	MXI System Controller	S4	MXIbus controller enabled	MXIbus controller disabled
10	Logical Address	---	Set the logical address to 1, 2, or 3	Set the logical address to the number above a window boundary (e.g. boundary = 128, logical address = 129)
11	VXIbus Slot 0 Device	S1, S8	Non-Slot 0	Slot 0
12	Front Panel Pushbutton	S7	SYSRESET* asserted	SYSRESET* asserted
13	VME BTO Chain Position	W7	1 extender, non-slot 0	1 extender, slot 0
14	VMEbus Request Level	W1 - W5	Level 3 requester	Level 3 requester
15	CLK10 Source	W9, W10	Do not source CLK10	On-board 10 MHz VXI-MXI installed in slot 0
16	CLK10 Mapping	W1 - W3	CLK10 disabled	CLK10 disabled

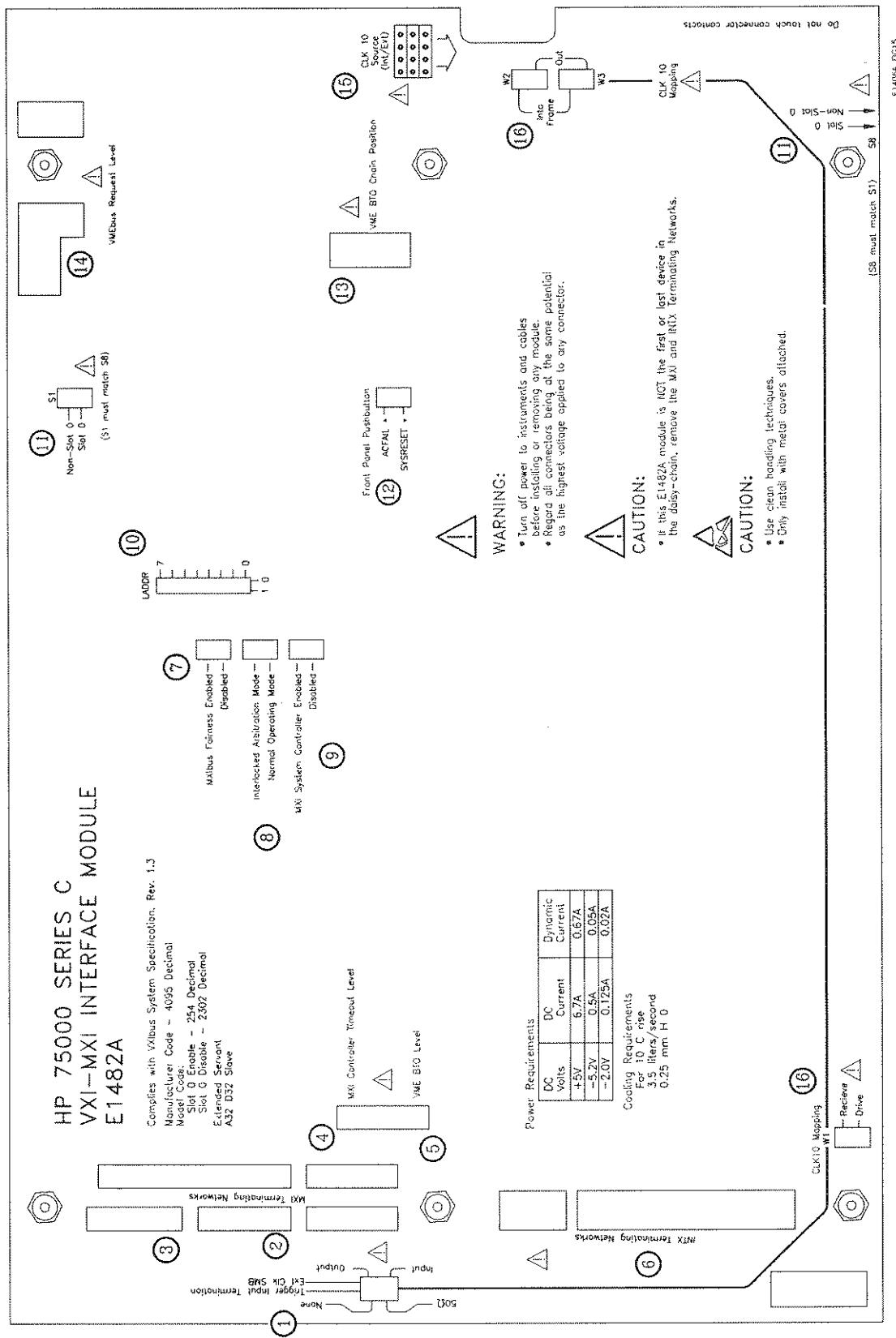


Figure 15. Configuring the HP E1482A VXI-MXI Extenders

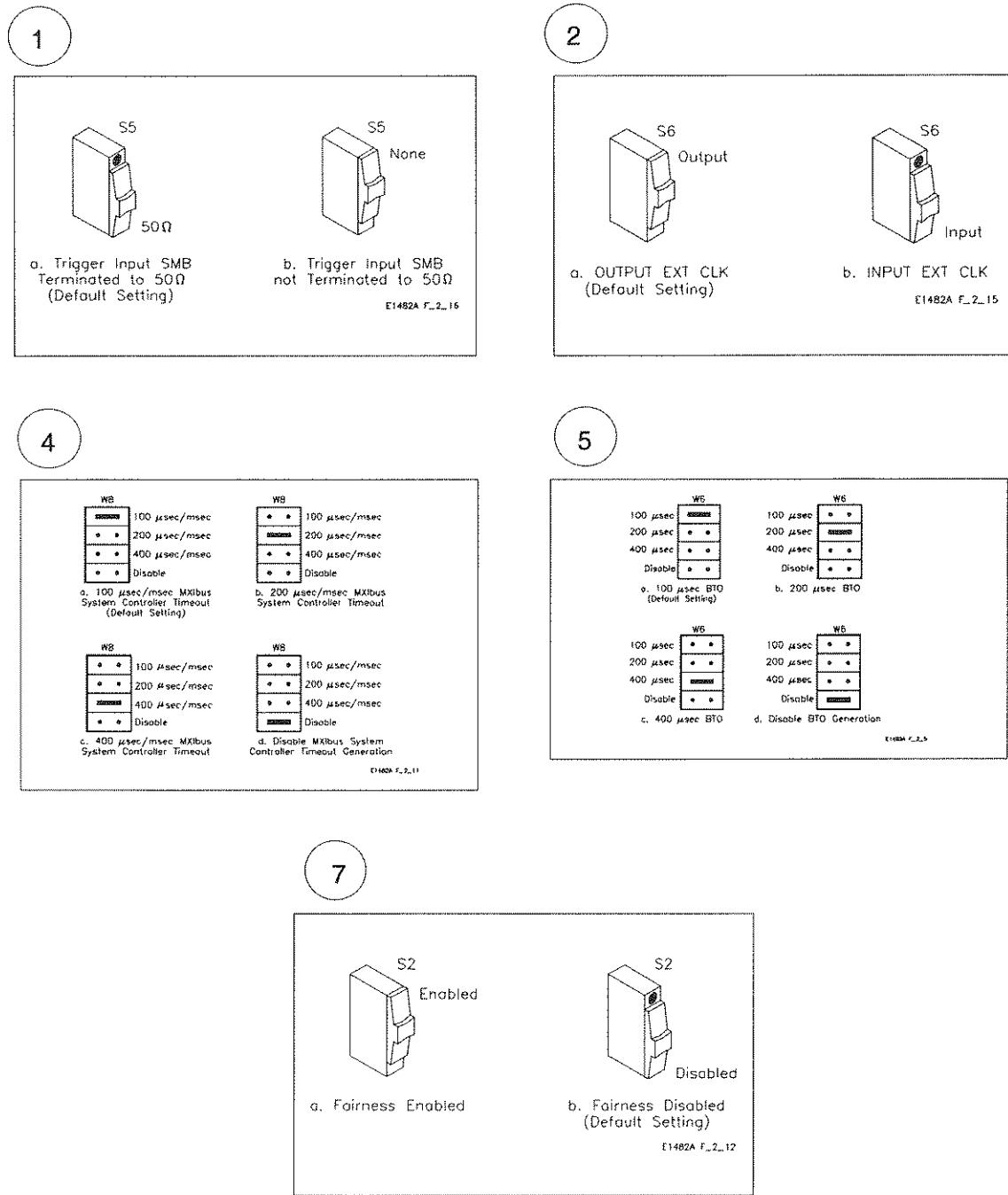
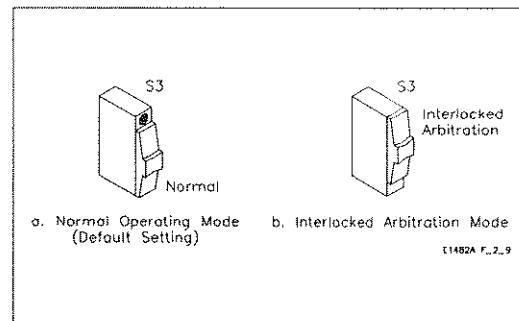
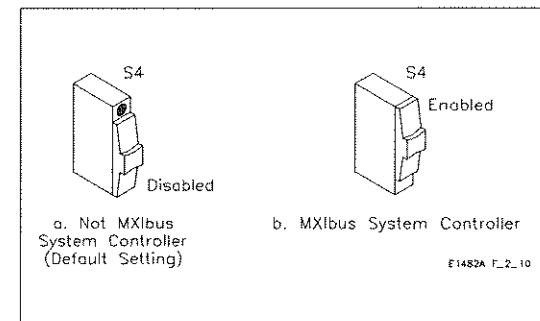


Figure 16. HP E1482A Switch and Jumper Settings

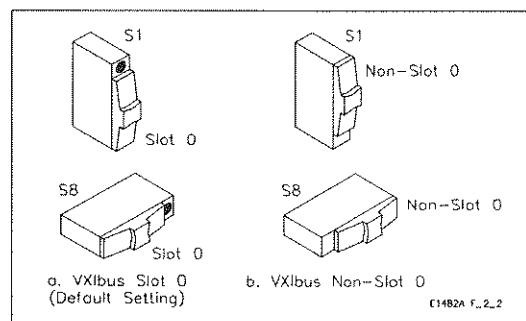
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9



11



12

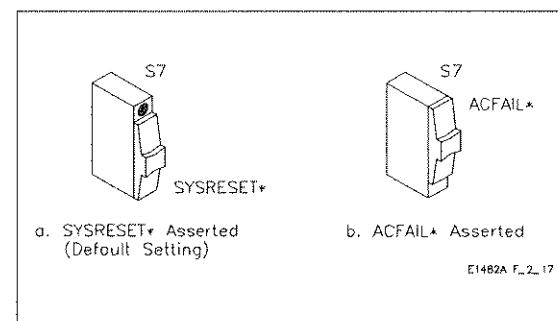
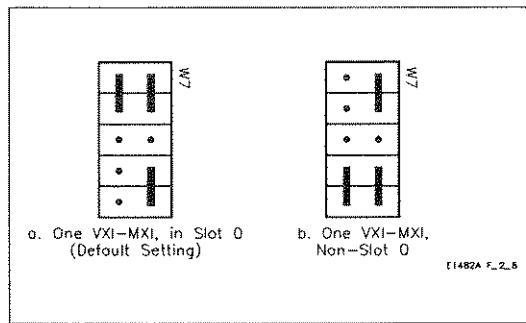
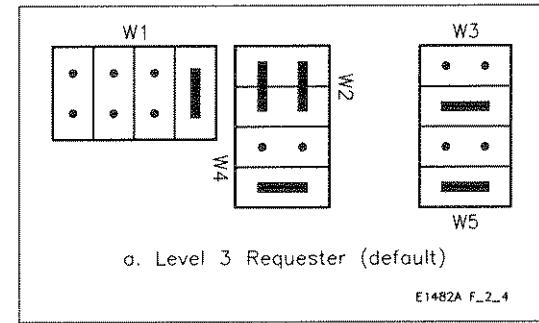


Figure 16. HP E1482A Switch and Jumper Settings (Cont'd)

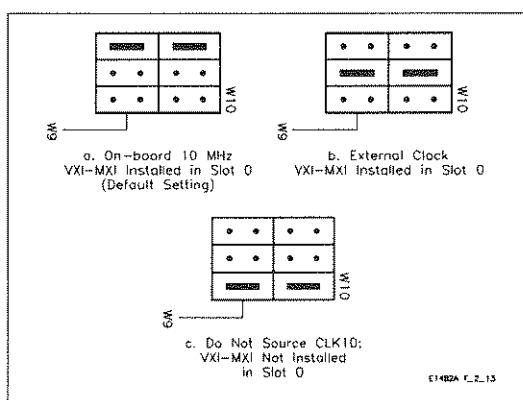
13



14



15



16

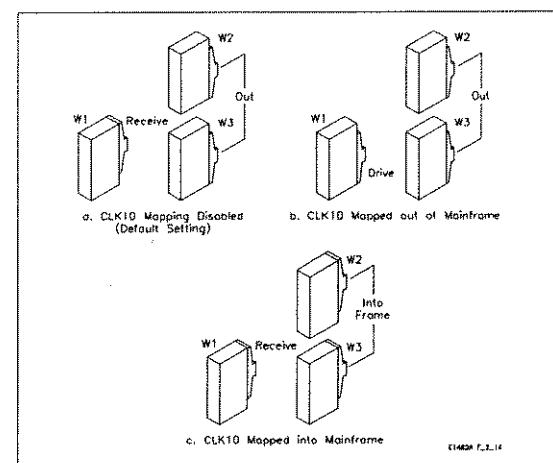


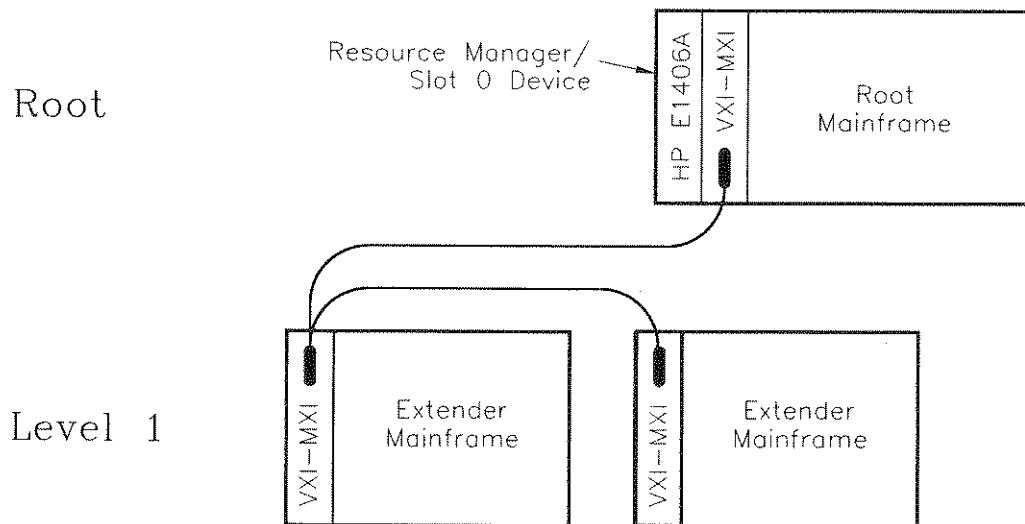
Figure 16. HP E1482A Switch and Jumper Settings (Cont'd)

Planning a VXI-MXI System

Before setting the logical addresses of the devices in your VXI-MXI system, you must determine in which mainframes the modules will be installed. The basic multi-mainframe system linked by HP E1482 VXI-MXI extender modules is shown in Figure 17. The mainframe which contains the resource manager and slot 0 device is known as the **root mainframe**. VXI-MXI extender modules connected to the root (VXI-MXI) extender module link the extender mainframes to the system.

NOTE

Due to the complexities involved in multi-level VXI-MXI systems (i.e. mainframes with more than one VXI-MXI extender module), and the decrease in system performance, we do not recommend installing more than one HP E1482 VXI-MXI module per mainframe.



E1406 FIG17

Figure 17. VXIbus System with VXI-MXI Mainframe Extender Modules

Hardware Installation Guidelines

The following guidelines apply when installing VXI-MXI modules into a system with the HP E1406/05 Command Module or V/382 embedded controller as the resource manager and slot 0 device.

- The VXI-MXI module in the "root" mainframe should be installed in the slot next to the resource manager device. If the resource manager is the HP E1406/05 Command Module (installed in slot 0), install the VXI-MXI module in slot 1.

- The VXI-MXI module in all extender mainframes must be installed in slot 0. All VXI-MXI modules must be configured for INTERLOCKED bus arbitration (factory setting).
- An extender mainframe is identified by the logical address of the VXI-MXI module installed in slot 0. The MXibus (or interconnect bus) between the mainframes is identified by the logical address of the VXI-MXI module in the root mainframe.
- The VXI-MXI module must do the (data transfer) bus arbitration. This functionality must be disabled on the resource manager/slot 0 device. Figure 14 shows how this is disabled on the HP E1406/05 Command Module and on the V/382 embedded controller.

Setting Up Logical Address Windows

Each mainframe in a multiple-mainframe VXIbus system is allocated a logical address window. The window is allocated by the resource manager during the power-on sequence. The size and starting address of the logical address window is determined by the logical addresses of the modules in each mainframe. When setting the logical addresses of the modules, note the following guidelines.

- The logical address of the VXI-MXI extender module in the root mainframe should be set to 1, 2, 3, ... The logical addresses of the VXI-MXI modules in the extender mainframes should be set to values near the starting address of that mainframe's logical address window. For example, if a mainframe's logical address window is 128 to 159, set the VXI-MXI extender module's address to 129, 130, ... This allows for a register-based module to be set to 128, and then be assigned a secondary HP-IB address (16) by the Command Module resource manager.
- The logical address window size is set to a power of 2 (2, 4, 8,...). The size is the number of logical addresses in the window. The starting address is an integer multiple of the size. For example, to allocate a window for 30 logical addresses, the resource manager will set a window size of 32. Valid starting addresses are 0, 32, 64, 96, 128, 160, 192, or 224.

Incidentally, the logical address of the VXI-MXI extender module in that mainframe should be set to 1, 33, 65, 97, ...

- The logical address window of the root mainframe must be a valid window (valid starting address and size), and include all of the modules in all of the extender mainframes connected to it.
- No module in one mainframe can be in another mainframe's logical address window. Therefore, the logical addresses within a mainframe should be set such that as small a window as possible is allocated.

- The logical address window of an extender mainframe must include all modules in that mainframe. The VXI-MXI extender module, however, does not have to be within the window, but must not be within the window of another mainframe.

Table 2 and Figure 18 illustrate the window size and starting logical address guidelines. The two examples that follow show how to select logical addresses to minimize a mainframe's logical address window.

Table 2. Logical Address Window Size and Starting Addresses

Window Size (number of addresses)	Starting Addresses (Boundaries)
2	0, 2, 4, 6, 8, 10, ... all even numbers up to 254 inclusive
4	0, 4, 8, 12, 16, 20, 24, 28, 32, 36, 40, 44, 48, 52, 56, 60, 64, 68, 72, 76, 80, 84, 88, 96, 100, 104, 108, 112, 116, 120, 124, 128, 132, 136, 140, 144, 148, 152, 156, 160, 164, 168, 172, 176, 180, 184, 188, 192, 196, 200, 204, 208, 212, 216, 220, 224, 228, 232, 236, 240, 244, 248, 252
8	0, 8, 16, 24, 32, 40, 48, 56, 64, 72, 80, 88, 96, 104, 112, 120, 128, 136, 144, 152, 160, 168, 176, 184, 192, 200, 208, 216, 224, 232, 240, 248
16	0, 16, 32, 48, 64, 80, 96, 112, 128, 144, 160, 176, 192, 208, 224, 240
32	0, 32, 64, 96, 128, 160, 192, 224
64	0, 64, 128, 192
128	0, 128
256	0



Figure 18. Logical Address Window Boundaries

Example Summary

The first example illustrates setting up a window for only two addresses. This shows how setting two logical addresses, even though adjacent to each other, can require a logical address window that spans the range of available addresses (0 to 255). You are shown how selecting addresses with regard to allowed starting addresses (boundaries) can minimize the logical address window.

The second example illustrates a two mainframe system with 10 instrument identifier (divisible by 8) logical addresses required for each mainframe.

Example # 1

This example shows how the selection of logical addresses can determine the logical address window size.

Minimizing the Logical Address Window Size

Assume that you have set the logical addresses of two modules to 128 and 129. By setting one of the addresses to an allowable starting address for a window size of 2 (Table 2), the logical address window is exactly two addresses wide.

If the modules had been set to logical addresses which were multiples of 8 (e.g. 128 and 136), the resource manager would have set the window size to 16 (128 through 143 inclusive). Though only two of the 16 addresses available in the window are used, the other 14 addresses are unavailable to the rest of the system.

Maximizing the Logical Address Window Size

Assume that the logical addresses of the two modules had been set to 127 and 128. For the resource manager to allocate a window that includes both 127 and 128, it must set a logical address window that includes all logical addresses from 0 through 255 (see Figure18). This is because 128 is a boundary. Window sizes of 2 through 128 end at 127 and begin at 128. Only a window size of 256 includes 127 and 128. Thus, all logical addresses for the system would be included in that single window and none would be available for any other mainframe.

Example # 2

This example shows how logical addresses are set to minimize the logical address windows of two mainframes.

Set Up

Assume you want to set up a system consisting of two mainframes.

- Mainframe 1 requires an address window of ten instrument identifier (divisible by 8) addresses. The mainframe also includes the resource manager and slot 0 device.
- Mainframe 2 requires an address window for ten instrument identifier addresses.

Mainframe 1 (Root mainframe)

The resource manager is at logical address 0. The first ten multiples of 8 are: 8, 16, 24, 32, 40, 48, 56, 64, 72 and 80. These are among the (multiple of 8) logical addresses the modules can be set to.

The resource manager does not set a logical address window for addresses in its own mainframe. It does, however, set a logical address window that includes all modules in all extender mainframes (see "Setting Up Logical Address Windows").

Mainframe 2 (Extender mainframe)

Assuming logical addresses from 8 through 80 are used in the root mainframe, the resource manager will allocate a window from 128 through 255 in the extender mainframe. Any 10 logical addresses in this range which are instrument identifier addresses can be used by the modules.

Address Distribution

Figure 19 is an example of a three-mainframe VXIbus system and how logical addresses from 0 to 255 are distributed among the mainframes. The addresses are set such that the logical address windows allow 15 instrument identifier addresses (multiples of 8) in the root mainframe, and eight instrument identifier addresses in each extender mainframe.

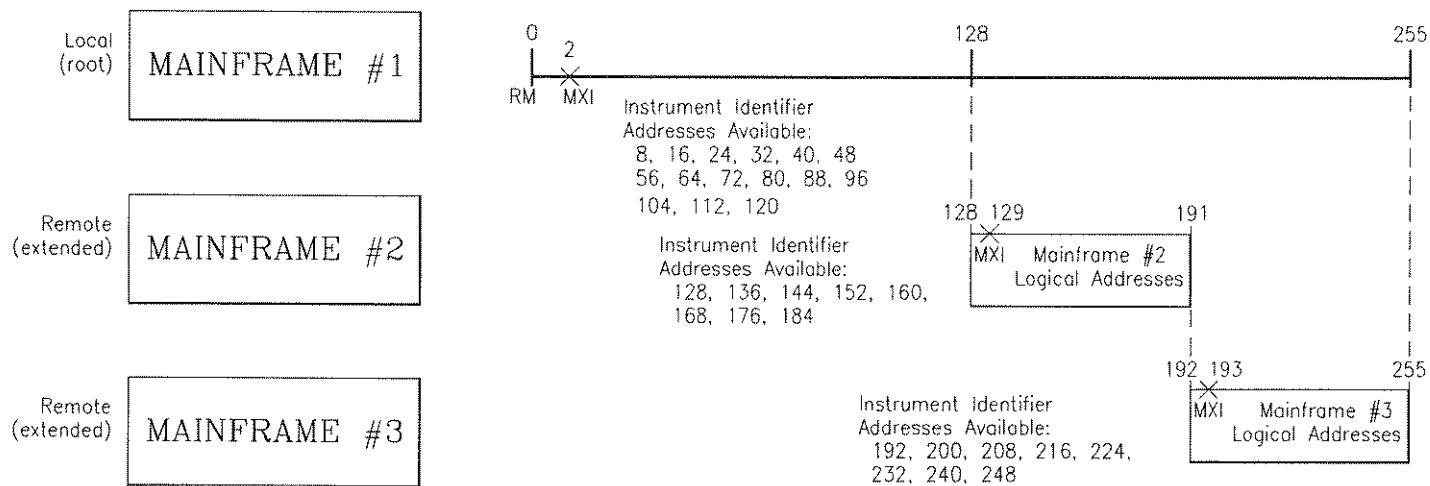


Figure 19. Multiple Mainframe Logical Address Distribution

E1406A FIG3-4

STEP 3: Create Instruments

Step 3 in setting up a VXIbus system is to create instruments from the Hewlett-Packard message-based and register-based plug-in modules that are servants to the HP E1406/05 Command Module. These "instruments" can then be programmed with the Standard Commands for Programmable Instruments (SCPI) language.

NOTE

If your system is to contain message-based (or register-based) modules which are servants to the embedded controller, the following logical addressing conventions do not apply.

How to Create an Instrument

Instruments comprised of Hewlett-Packard message-based and register-based modules which are servants to the E1406/05 Command Module are created according to the following rules:

- Each instrument must have one plug-in module assigned as an *Instrument Identifier*. The Instrument Identifier is the module whose logical address is a multiple of 8 (e.g. 8, 16, 24,...).
- The Instrument Identifier is the lowest logical address in the instrument. The Command Module maps the Instrument Identifier logical address to a secondary HP-IB address by dividing the logical address by 8. Thus, a logical address of 8 maps to a secondary HP-IB address of 1; logical address 16 maps to secondary address 2; logical address 24 maps to 3 and so on.
- If an instrument consists of a single module, then its logical address must be set to an Instrument Identifier address (multiple of 8).
- An instrument consisting of multiple modules is called a virtual instrument. The modules of the virtual instrument must be assigned successive logical addresses beginning with the address of the Instrument Identifier. For example, to create a scanning multimeter virtual instrument which consists of a multimeter and two multiplexers, the logical addresses could be set to:

24	(multimeter)
25	(1st multiplexer)
26	(2nd multiplexer)

Note, however, you **cannot** combine multiple modules such as multimeters, counters, function generators, etc., into virtual instruments.

Setting the Logical Address

The logical addresses of most plug-in modules are set using a row of switches (known as static configuration). The logical addresses of selected modules can be set programmatically (known as dynamic configuration). If you intend to dynamically configure a module, set the logical address switch to 255. The system's resource manager will then assign a logical address. If there are no dynamically configurable devices in your system, 255 is a valid address.

Logical Address Guidelines

- Notice the factory-set logical address. Most Hewlett-Packard modules (i.e. DMMs, counters, function generators) have a factory-set address that is an Instrument Identifier.
- Valid logical addresses are 1 through 255. To dynamically configure a module which supports dynamic configuration, its logical address must be set to 255. However, if a statically configured module is set to 255, no dynamic configuration occurs (by the Command Module resource manager).
- If your system consists of statically and dynamically configured modules, set the statically configured modules to the "lower" multiples of 8 (e.g. 8, 16, 24). The dynamically configured modules will be assigned Instrument Identifier addresses beginning with the lowest available multiple of 8. If all multiples are used, the dynamically configured module is given the first available address.
- A plug-in module with a logical address that is not a multiple of 8, or that is not part of a virtual instrument, is an unassigned module. Such modules must be programmed at the register level, rather than with SCPI commands. (A secondary HP-IB address can be given to an unassigned module with the Command Module's User-Defined Commander/Servant Hierarchy table (see the HP E1406 User's Manual).)

Downloading Device Drivers

Device (instrument) drivers contained in the HP E1406/E1405 Command Module enable register-based modules to be programmed using SCPI commands. Table 3 lists the device drivers which are factory-installed.

Drivers which are not factory-installed ship with the module. Instructions for downloading the drivers are included (Downloading Device Drivers Installation Note p/n E1400-90021). The installation and configuration procedures discussed in this (E1406-90020) manual apply to these modules. If a driver is not installed, the resource manager will report the following message at the end of the power-on sequence. The drivers can then be installed according to the installation note.

WARNING: DEVICE DRIVER NOT FOUND

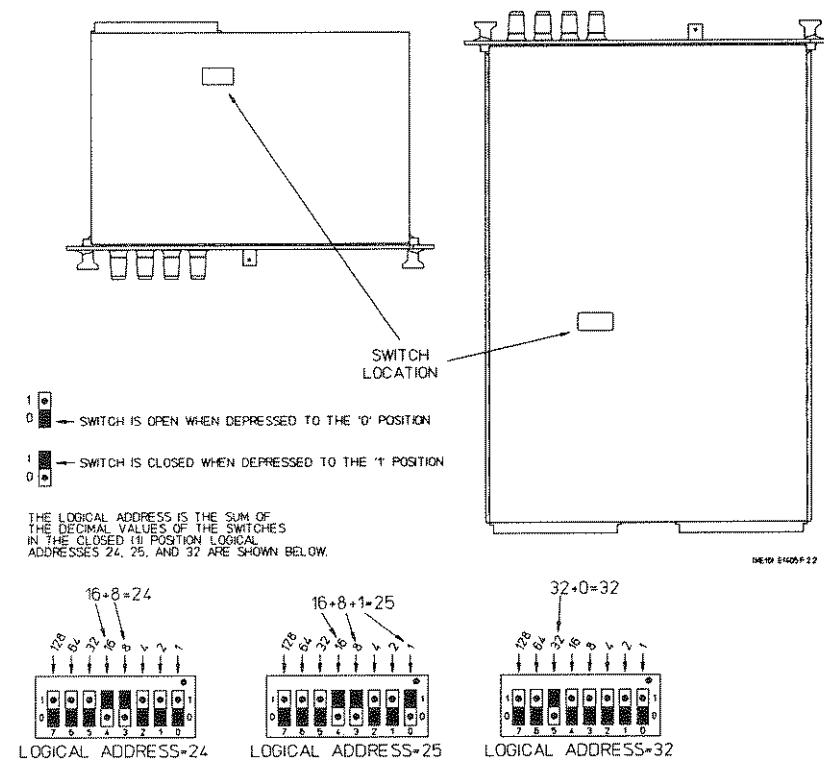


Figure 20. Setting a Logical Address

Table 3. HP E1406A/E1405B Factory-Installed Drivers

HP E1406/E1405 Factory-Installed Instrument Drivers (Register-Based Modules)	
System Instrument	
HP E1326B/E1411B	5 1/2-Digit Multimeters
HP E1328A	4-Channel D/A Converter
HP E1330B	Quad 8-Bit Digital Input/Output
HP E1332A	4-Channel Counter/Totalizer
HP E1333A	3-Channel Universal Counter
Switch Cards	Multiplexers, Matrix, General Purpose

STEP 4: Install Modules

This step describes how to install A-, B-, and C-Size modules into the HP 75000 Series C mainframe. The mainframe backplane is automatically configured (e.g. no switches need to be set) when a module is installed.

CAUTION

It is your responsibility to ensure adequate cooling is supplied to all modules installed in the mainframe. Section B.7.2.4 of the VXIbus Specification (Revision 1.3) discusses module cooling requirements. Section B.7.3.5 discusses mainframe cooling requirements.

NOTE

When installing VME devices in the HP 75000 Series C mainframe, the devices must not be in conflict with the A24/A32 addresses allocated by the Command Module when functioning as the resource manager. Refer to the HP E1406 user's manual for information on A24/A32 address mapping.

B-size modules can be installed on the mainframe backplane as described in the section "Installing B-Size Modules", or can be installed using the following carriers. We recommend that A-size modules be installed using the carriers.

- **HP E1403 A/B-size Module Carrier** extends the P1 connector on the VXIbus backplane and mounts the (A/B-size) modules flush with other C-size modules. This carrier is recommended for all Hewlett-Packard B-size modules which have only the P1 connector.
- **HP E1402 VME Module Adapter** allows B-size VME modules to be plugged into the VXIbus backplane.

Installation manuals are shipped with each carrier/adapter described. If you are installing A- or B-Size modules and C-Size modules in the same mainframe, install the A- and B-Size modules *first*. You will generally need more working room to install the smaller modules.

WARNINGS

SHOCK HAZARD. Only service-trained personnel who are aware of the hazards involved should install, remove, or configure any plug-in modules. Before you touch any installed module, disconnect AC power from the mainframe.

To avoid electrical shock, always cover unused slots with the faceplate panels that came with the mainframe. Refer to Appendix B in this manual for the faceplate panel part numbers if you wish to order additional panels.

Installing B-Size Modules

There are two ways to install B-size modules in the C-size mainframe without using module carriers. The methods are described below.

METHOD 1: Remove the front top and bottom plastic module guides from the appropriate mainframe slot. To remove a module guide, grasp the guide firmly and apply a left and right rocking motion.

With the front top and bottom module guides removed, slide the module between the front panel mounting brackets and insert the card edges into the rear module guides. After the card edges properly enter the module guides, slide the module in until the module connects firmly with the backplane connectors. In this configuration, the module is supported only by the rear module guides and backplane connectors.

METHOD 2: Remove the (B-size) module's front panel. With the panel removed, insert the card edges into the front module guides and slide the module into the mainframe. The front module guides should align the card edges with the rear module guides. After verifying that the card edges properly enter the module guides, slide the module in until the module connects firmly with the backplane connectors. In this configuration, the module is supported by the rear module guides and backplane connectors *only*.

Installing C-Size Modules

Install the C-size modules in accordance with the following guidelines:

- Modules can be installed in any slot, and need not be installed in adjacent slots. However, when installing multiple modules which comprise a virtual instrument, the modules should be installed in adjacent slots. This allows cables to be easily connected between the modules.

- When installing a virtual instrument such as a scanning multimeter, install the multimeter to the left of the multiplexers, which are then installed in adjacent slots to the right.
- To install a C-Size module, place the module's card edges into the front module guides (top and bottom). Slide the module to the back of the mainframe until the module connects firmly with the backplane connectors. Secure the module's front panel to the mainframe chassis using the module's mounting screws.

Using a Chassis Shield

The HP E1409A Chassis Shield is the Hewlett-Packard implementation of Section B.7.3.4 of the VXIbus Specification (Revision 1.3) that allows grounded shielding between mainframe slots. Typical applications for the chassis shield include isolating modules that generate electro-magnetic interference (EMI) at excessive levels, and shielding modules from noise sources during sensitive measurements.

The chassis shield assembly contains a plated-steel shield with four conductive chassis shield guides and mounting hardware. Two adhesive-backed thermoplastic insulators are also included and can be attached to the chassis shield if desired. Since the chassis shield fits *between* slots in the mainframe, you do not lose the use of a slot by installing the shield. An installation manual is included with the shield.

Using Faceplate Panels

The mainframe is shipped from the factory with faceplate panels installed to cover the module slots. Three 1-slot panels, one 3-slot panel, and one 7-slot panel are installed to cover the 13 slots. To avoid electrical shock, always use the faceplate panels to cover unused slots.

STEP 5: Set Up the Mainframe for AC Power

The HP E1401A and E1400B mainframe installation includes:

- setting the line voltage selector (E1400B)
- installing the line fuse
- connecting the power cord

Line Voltage Selector (HP E1401A)

The E1401A mainframe power supply automatically senses and adjusts for line voltages between 100/120VAC and 220/240VAC, at line frequencies between 48 Hz and 66 Hz.

Line Voltage Selector (HP E1400B)

The line voltage selector is located on the E1400B mainframe's rear panel and has two positions: 100/120VAC and 220/240VAC. The 100/120V position is for the 90-132 VAC range, and the 220/240V position is for the 198-264 VAC range. (Before changing the line voltage setting, make sure the mainframe's power cord is not attached.)

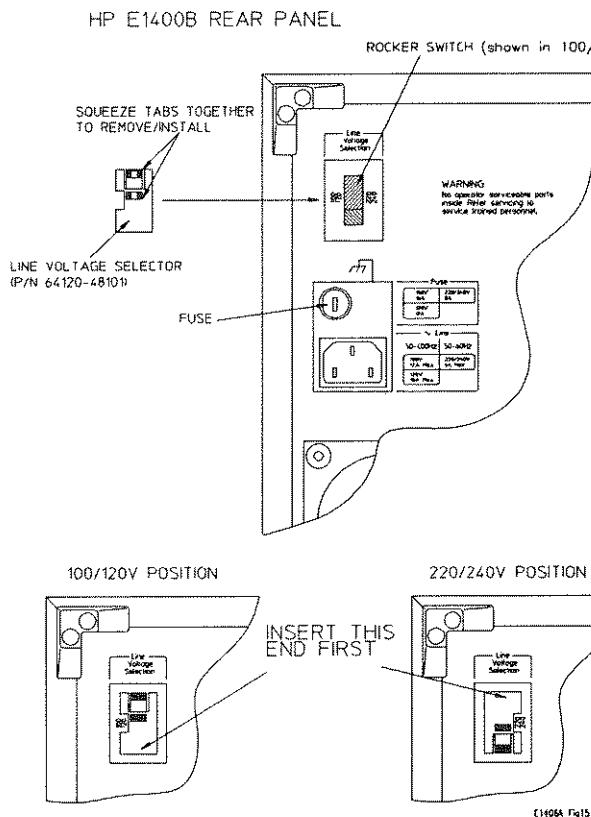


Figure 21. HP E1400B Line Voltage Selector

Installing the Line Fuse

The E1401A and E1400B mainframes *do not* have a line fuse installed when shipped from the factory. Instead, three fuses and a fuseholder cap are provided (see below). Use this fuseholder cap (HP part number 2110-0565) with any of the three fuses.

The line fuse holder is located on the mainframe's rear panel. Before installing the fuse, make sure the mainframe's power cord is not attached. Insert one end of the fuse into the fuseholder cap. Insert the fuse/cap assembly into the fuse holder. With a small flatblade screwdriver, push in on the fuseholder cap and turn it clockwise.

Voltage	Line Fuse	Part Number
90 - 107 VAC	15A 250V	2110-0054
108 - 132 VAC	12A 250V	2110-0249
180 - 264 VAC	8A 250V	2110-0342

Power Cords

The power cords for the E1401A and E1400B mainframes follow. If you received the wrong power cord, notify your HP Sales Office for replacement.

Table 4. HP E1401A Power Cords

Country	Part Number	Volts	Rated Amps	Type
U.K.	8120-5392	250 VAC	10A	Right Angle Connector
Australia	8120-5393	250 VAC	10A	Right Angle Connector
Europe	8120-5394	250 VAC	10A	Right Angle Connector
*U.S./Canada	8120-5395	125 VAC	13A	Right Angle Connector
Switzerland	8120-5397	250 VAC	10A	Right Angle Connector
Denmark	8120-5398	250 VAC	10A	Right Angle Connector
Japan	8120-5400	125 VAC	15A	Right Angle Connector

Power cords supplied by HP have polarities matched to the power input socket on the instrument:

L= Line or Active Conductor (also called "live" or "hot")

N= Neutral or Identified Conductor

E= Earth or Safety Ground

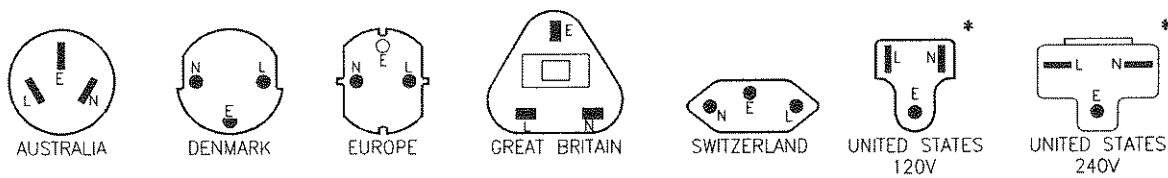
NOTE:

Plugs are viewed from connector end. Shape of molded plug may vary within country.

* CSA certification includes only these Power Plugs.

E1406 TABLE_4

POWER CORDS



Country	Part Number	Opt.	Voltage
Australia	8120-1369	901	250V 6A
Denmark	8120-2956	912	250V 6A
Europe	8120-1689	902	250V 6A
Great Britain	8120-1351	900	250V 6A
Switzerland	8120-2104	906	250V 6A
*United States	8120-1378	903	120V 10A
*United States	8120-0698	904	240V 10A

Power cords supplied by HP have polarities matched to the power input socket on the instrument:

L= Line or Active Conductor (also called "live" or "hot")

N= Neutral or Identified Conductor

E= Earth or Safety Ground

NOTE:

Plugs are viewed from connector end. Shape of molded plug may vary within country.

* CSA certification includes only these Power Plugs.

POWCRDS

Figure 22. HP E1400B Power Cords

STEP 6: Connect Interface Cable(s)

NOTE

Refer to your controller's documentation for information on connecting the keyboard and video cables and other peripherals.

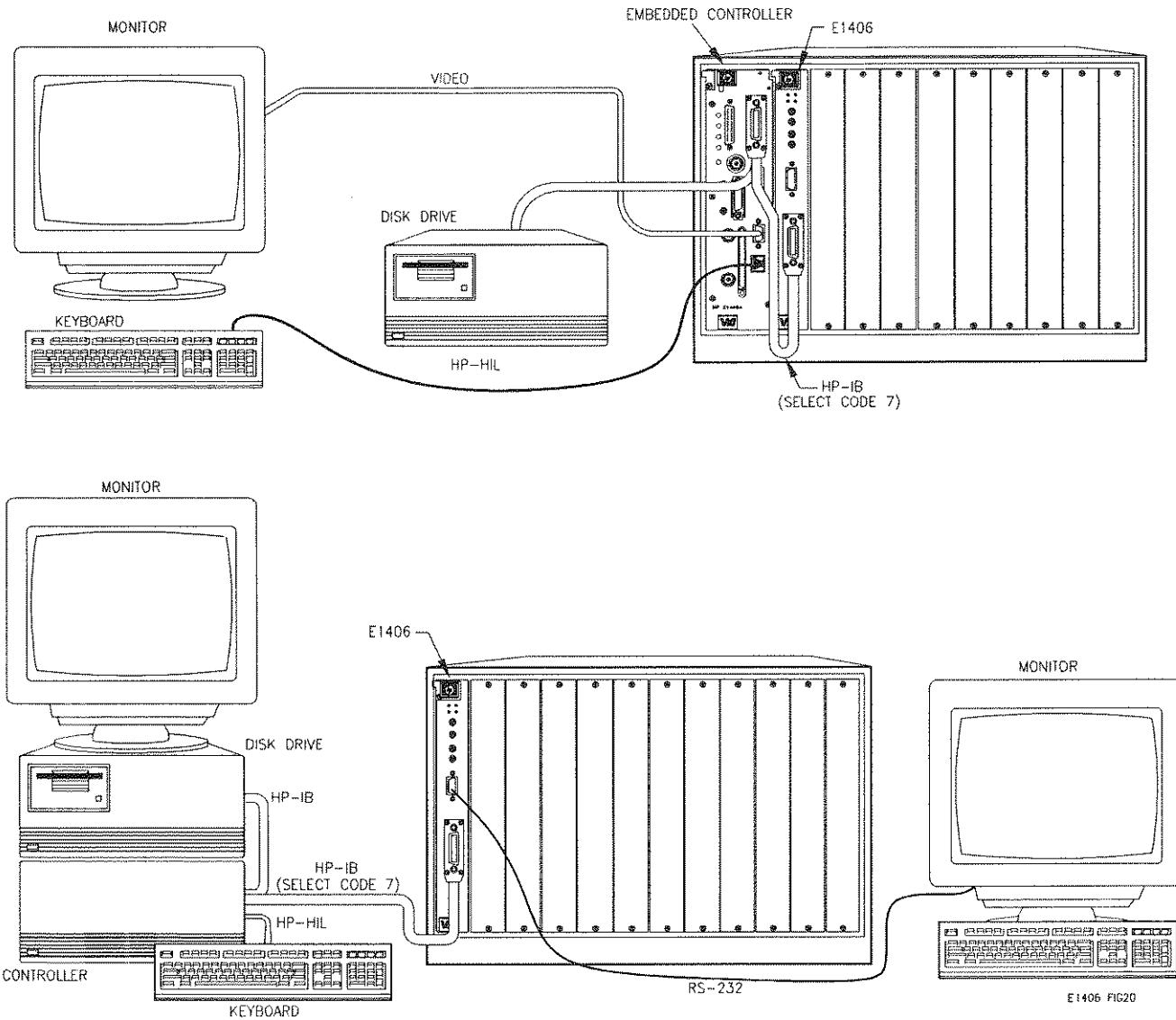


Figure 23. Typical HP-IB Connections

Connecting Display Terminals and PCs

You can connect a terminal or PC to the Command Module's RS-232 port. The terminal/PC allows you to monitor the Command Module's power-on and configuration sequence. In addition, the terminal/PC can function as a front panel to your VXIbus C-size system.

The Command Module's serial interface is factory-configured as shown below. The section, "Configuring the RS-232 Interface", describes how the serial interface settings can be changed. The module has a 9-pin DTE RS-232 connector.

Baud Rate	9600	RecvPace	Xon/Xoff
Parity	None	XmitPace	Xon/Xoff
Data Bits	8	Character Size	EnqAck
			No (HP terminals)

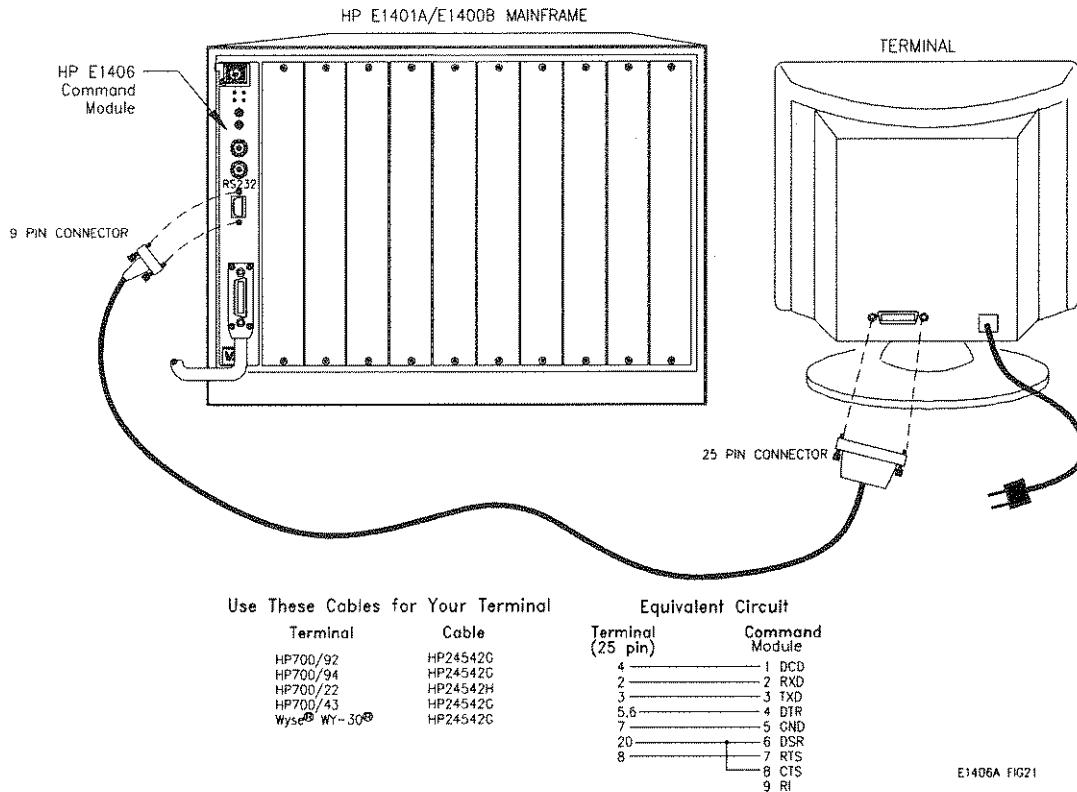


Figure 24. Connecting a Display Terminal

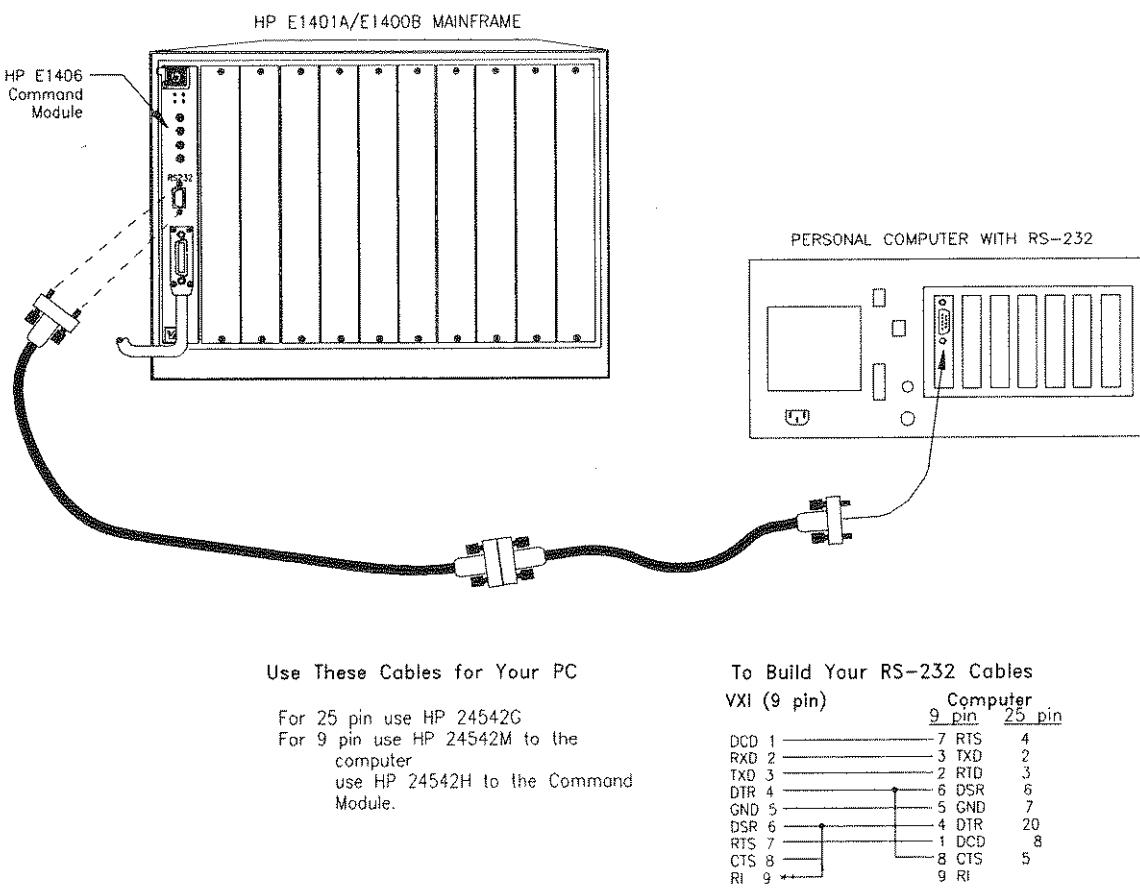


Figure 25. Connecting a PC to the Command Module

STEP 7: Apply Power

Apply power by pressing the mainframe's power switch. When power is applied, the HP E1406/05 Command Module and other plug-in modules begin their self test routines. If a plug-in module fails its self test, the device is taken off-line by the Command Module and is excluded from the resource manager's system configuration process.

If the Command Module fails its self test, the "Failed" annunciator lights up on the faceplate. Should this occur:

- turn the mainframe off, remove the Command Module, check the configuration switches (i.e. logical address, slot 0/system controller enable).
- if it still fails, turn the mainframe off, remove all other installed modules. Apply power, and if the Command Module passes its self test, add the other plug-in modules one at a time - cycling power each time.
- if necessary, call your nearest Hewlett-Packard sales and service office.

When using the Command Module for the first time or when the mainframe has not been turned on for at least one week, leave the mainframe on for at least 15 hours to fully charge the Command Module's battery.

Power-On Sequence

The Command Module's power-on and configuration sequence is shown in Figure 26. This sequence can be monitored on an RS-232 terminal or printer (configured as shown in Step 6) connected to the module's RS-232 serial interface port. Pressing CTRL S on the terminal keyboard pauses the sequence. Pressing CTRL Q allows the sequence to resume. Note that once the sequence is paused, it remains paused until CTRL Q is pressed.

NOTE

If a serial terminal or printer is not available, the program in Step 8 can be used to check your system.

Configuration and Start-Up Errors

If a configuration or start-up error such as an invalid address or failed self test occurs, the error is reported in the power-on and configuration sequence. A list of the configuration and start-up error messages and their causes can be found in the "Configuration and Start-up Errors" section of this guide.

```

Testing ROM
Testing 512K Bytes RAM
    Passed
Testing CPU
    CPU Self Test Passed
    HP-IB address: 09
    Talk/Listen
    Command Module ladd = 0
    Command Module servant area = 255
    Command Module VME bus timeout -- DISABLED
    Searching for static devices in mainframe 0
        SC device at ladd 0 in slot 0
        SC device at ladd 1 in slot 1 -- VXibus extender
        SC device at ladd 24 in slot 6
    Searching for static devices on interconnect bus 1
        SC device at ladd 129 in slot 0 -- VXibus extender
2.   Searching for static devices in mainframe 129
        SC device at ladd 128 in slot 5
    Searching for dynamic devices in mainframe 129
        DC device in slot 9 moved to ladd 136, block size = 1
        VXibus extender 129 Ladd window range: 128 to 143, INWARD
        VXibus extender 1 Ladd window range: 128 to 143, OUTWARD
    Searching for dynamic devices in mainframe 0
    Searching for pseudo devices
        ladd 240, IBASIC
    Configuring Commander / Servant hierarchy
        ladd = 0, cmdr ladd = -1
        ladd = 24, cmdr ladd = 0
        ladd = 128, cmdr ladd = 0
        ladd = 136, cmdr ladd = 0
        ladd = 240, cmdr ladd = 0
3.   Validating Commander / Servant hierarchy
    Mapping A24 Memory
    Searching for A24 memory in mainframe 129
    VXibus extender 129 A24 window range: 00000000 to 00FFFFFF, OUTWARD
    VXibus extender 1 A24 window range: 00000000 to 00FFFFFF, INWARD
    Searching for A24 memory in mainframe 0
        ladd 0, offset = 00200000H, size = 131072 Bytes
    Mapping A32 memory
4.   Searching for A32 memory in mainframe 129
    VXibus extender 129 A32 window range: 00000000 to FFFFFFFF, OUTWARD
    VXibus extender 1 A32 window range: 00000000 to FFFFFFFF, INWARD
    Searching for A32 memory in mainframe 0
    Configure VXibus Extender A16 windows
    VXibus extender 129 A16 window range: 00000000 to 0000FFFF, OUTWARD
    VXibus extender 1 A16 window range: 00000000 to 0000FFFF, INWARD
    Configure VXibus Extender TTL trigger routing
    Configure VXibus Extender ECL trigger routing
    Configuring VME interrupts
        VME interrupt line 1 assigned to ladd 0, handler ID 1
        VME interrupt line 2 - no handler assigned
        VME interrupt line 3 - no handler assigned
        VME interrupt line 4 - no handler assigned
        VME interrupt line 5 - no handler assigned
        VME interrupt line 6 - no handler assigned
        VME interrupt line 7 - no handler assigned
5.   VXibus extender 129 interrupts: 1-OUT 2-DIS 3-DIS 4-DIS 5-DIS 6-DIS 7-DIS
    VXibus extender 1 interrupts: 1-IN 2-DIS 3-DIS 4-DIS 5-DIS 6-DIS 7-DIS

```

Figure 26. Command Module Resource Manager Configuration Sequence

6. SYSTEM INSTALLED AT SECONDARY ADDR 0
 VOLTMTR INSTALLED AT SECONDARY ADDR 3
 MBinstr INSTALLED AT SECONDARY ADDR 17
 MBinstr INSTALLED AT SECONDARY ADDR 18
 IBASIC INSTALLED AT SECONDARY ADDR 30
 IBASIC memory: 115232
 SYSTEM instrument started
 File System memory: 40131
 File System Started
 BNO issued to ladd 136, BNO response = FFFE
 Opening HP-IB/IBASIC access for message based device at sec addr 17
 BNO issued to ladd 144, BNO response = FFFE
 Opening HP-IB/IBASIC access for message based device at sec addr 18

1. The HP E1406/05 operating system performs a series of self-tests and clears its volatile RAM. The Command Module's HP-IB address, logical address, servant area, and VME (data transfer) bus timer functionality are reported. You must disable the VME bus timer when HP E1482A VXI-MXI mainframe extender modules are part of your system.
2. For each mainframe, the resource manager locates all statically configured modules, locates and configures all dynamically configurable modules, and then locates pseudo devices such as IBASIC. The VXI-MXI extender outward and inward logical address windows are then opened.
3. The resource manager establishes the VXIbus system's commander/servant hierarchies based on the commander's servant area and the servant's logical address. The Command Module in this configuration is the top-level commander, and as such, is not a servant to another commander (cmdr ladd = -1).
4. The resource manager allocates A24 and A32 addresses for those modules' memory requirements. Note that the offset is specified in hexadecimal and the size is specified in bytes. A24 and A32 address space is opened up to modules accessed through the VXI-MXI mainframe extender modules.
5. The resource manager allocates interrupt lines to all interrupt handlers in the system. Hewlett-Packard register-based modules have their interrupt line jumper set to '1' at the factory. In systems with multiple Command Modules the other interrupt lines are assigned. Modules controlled by those Command Modules must have their jumpers moved accordingly. Interrupt line '1' is enabled to route interrupts OUT from mainframe 137 to the handler in mainframe 0. Interrupt line '1' is enabled to route interrupts IN to the interrupt handler in mainframe 0 (VXIbus extender 2). All other interrupt routing lines are disabled since there are no other interrupt handlers.
6. The resource manager identifies the secondary HP-IB addresses in the system, starts the system instrument (i.e. Command Module), issues the Begin Normal Operation (BNO) command to its message based servants and opens HP-IB access to those modules.

Figure 26. Command Module Resource Manager Configuration Sequence (Cont'd)

Configuring the RS-232 Interface

The terminals supported by the Command Module RS-232 interface include:

- HP 700/92
- HP 700/94
- HP 700/22
- HP 700/41 and WYSE WY-30®

Other terminals which may work include:

HP 2392A

HP 2394A

DEC® VT100®

DEC® VT220®

WYSE® WY-50®

HP AdvanceLink terminal emulation software (configure as HP 2392A)

If after you connect a terminal you see only the 'Select an instrument' prompt, your terminal did not return a recognized ID. To set the terminal type, enter the terminal interface command:

ST HP (followed by **Return** for HP terminals)

or

ST VT100 (followed by **Return** for VT100® emulators)

or

ST VT220 (followed by **Return** for VT220® emulators)

or

ST WYSE30 (followed by **Return** for WY-30® emulators)

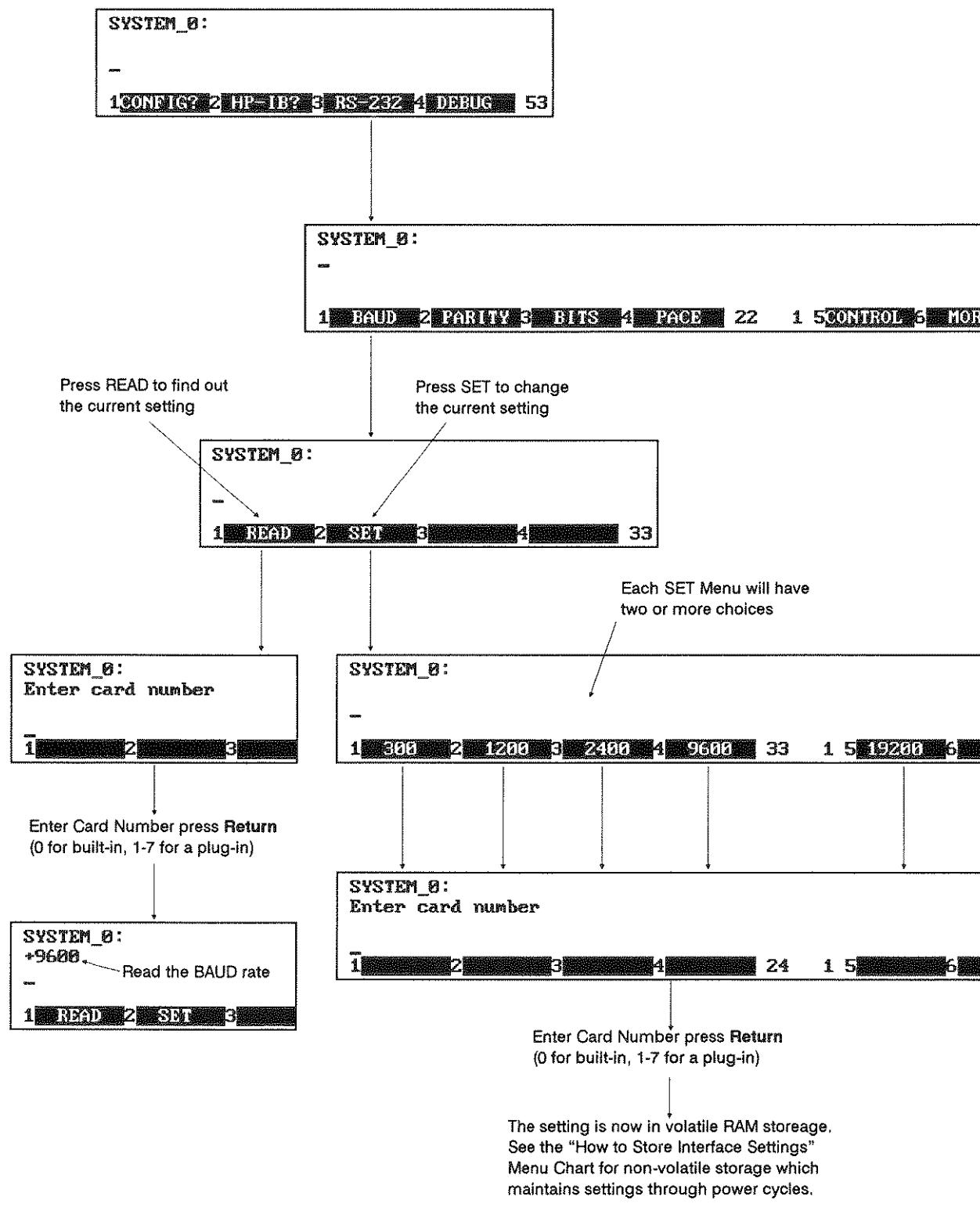
or

ST WYSE50 (followed by **Return** for WY-50® emulators)

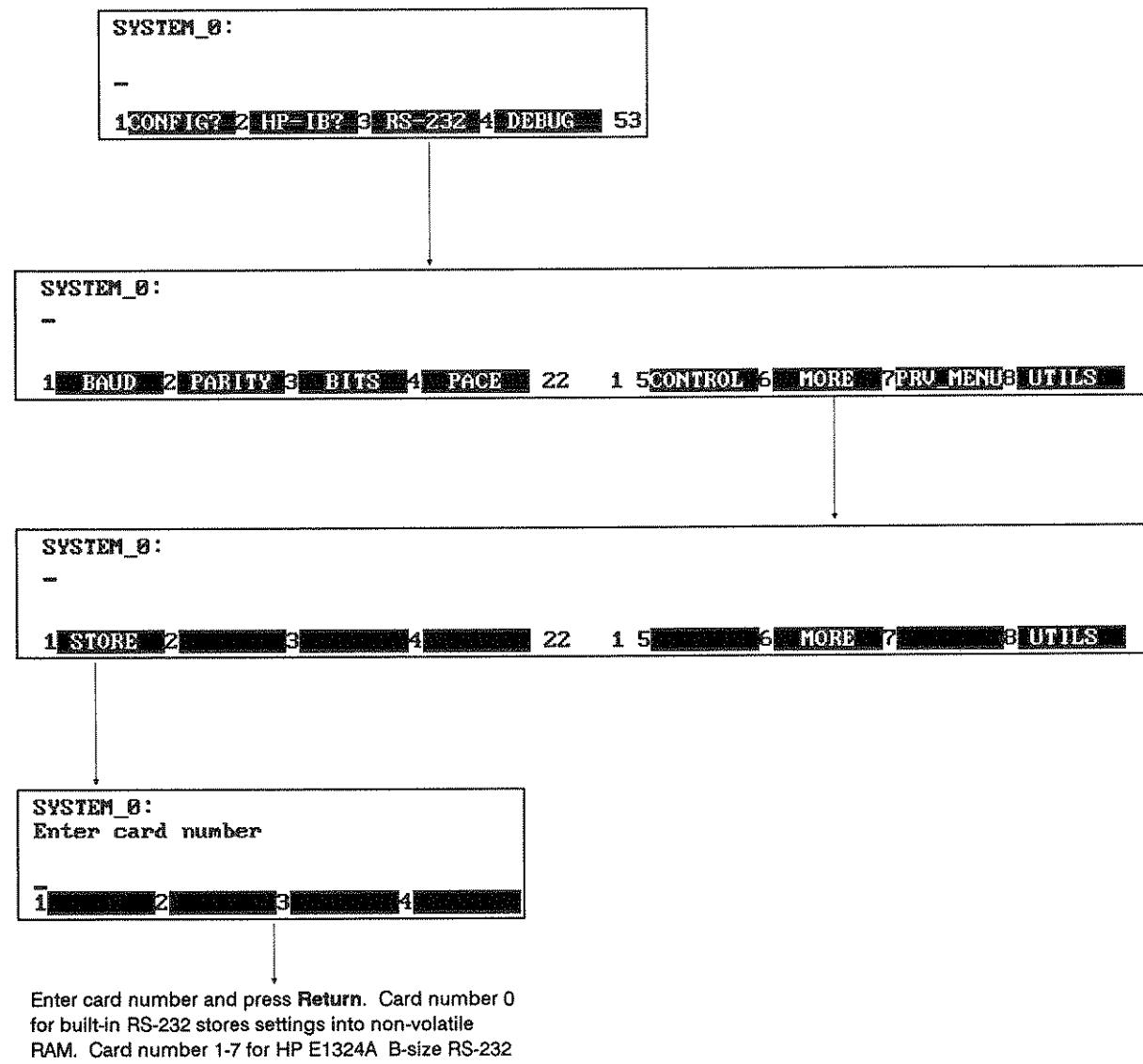
Once the RS-232 display terminal is communicating with the Command Module using the default interface configuration (see "Connecting a Display Terminal"), you can change the configuration so that it is better suited to your system. This is done using the display terminal interface menus shown on the following pages.

Note that changes to the Command Module serial interface configuration remain in effect until power is cycled, unless the changes are stored in non-volatile memory. See "How to Store the Serial Interface Configuration".

How to Use the Serial Interface Menus



How to Store the Serial Interface Configuration



Applying Power with an Embedded Controller

In systems with an HP E1499A V/382 embedded controller, perform the following steps once power is applied.

1. Run the V/382 resource manager program to configure the system. This is usually done automatically in the HP-UX operating system (`/usr/pil/bin/ivxirm`), but may not be done automatically in the HP BASIC workstation operating system.
2. After the resource manager program has completed, run the program `"usr/pil/bin/ivxisc"` (HP-UX) or `"IVXISC"` (HP BASIC workstation) and notice the configuration. A typical configuration sequence is shown on the following page.
3. Assign interrupt lines to interrupt handlers (commanders) and interrupters (servants) as required. See the following discussions: "What are Interrupt Lines?" and "Assigning Interrupt Lines" for more information.

NOTE

The HP BASIC workstation VXI drivers do not support nor configure the HP E1482 VXI-MXI extender modules.

What Are Interrupt Lines?

In a VXIbus system, communication and coordination between a commander and its servants is often achieved using the VXIbus backplane interrupt lines. Such is the case with the HP E1406/05 Command Module and Hewlett-Packard's register-based modules.

There are seven backplane interrupt lines. These lines are assigned to devices by the resource manager during the system's power-on sequence. When the V/382 controller is the resource manager, it assigns line 1 to itself, and assigns lines 2, 3, 4, ... to other interrupt handlers in the system. In systems containing a V/382 controller (resource manager) and an HP E1406/05 Command Module, the V/382 will assign the Command Module interrupt line 2 - if the Command Module has the next lowest logical address.

VXI Current Configuration:

VXI BUS: 0

	Device Logical Addresses: 0 2 24 128												
Slots:	0	1	2	3	4	5	6	7	8	9	10	11	12
Empty	-	-	-	-	-	-	-	-	-	-	-	-	-
Single Device	0	0	0	0	0	0	0	0	0	0	0	0	0
Multiple Devices	X			X									
VME													
Failed													

VXI Device Table:

Name	LADD	Slot	Bus	Manufacturer	Model
v300ctrlr	0	0	0	Hewlett Packard	E1480 Series 300 VXI Controller
cmdmodule	2	5	0	Hewlett Packard	E1405 Command Module
dmm	24	?	0	Hewlett Packard	E1411 5 1/2 digit DVM
dev1	128	?	0	Hewlett Packard	E1366 50 ohm VHF mux dual 4:1

? - slot number unknown

VME Device Table:

Name	Slot	Space	Size
No VME cards configured.			

Failed Devices:

Name	Slot	Manufacturer	Model
No FAILED devices detected.			

Protocol Support (Msg Based Devices):

Name	CMDR	SIG	MSTR	INT	FHS	SMP	RG	EG	ERR	PI	PH	TRG	I4	I	LW	ELW	1.3
v300ctrlr	X	X	X				X			X	X				X		
cmdmodule	X	X	X						X		X				X		

Commander/Servant Hierarchy:

v300ctrlr
 cmdmodule
 dvm
 vhfmux

Memory Map:

A24	Device Name
0x200000 - 0x0x21fff	cmdmodule
0x240000 - 0x027ffff	v300 ctrl

A32	Device Name
No devices mapped into A32 space.	

Interrupt Request Lines:

Name	Handler							Interrupter						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
v382ctrlr	X	XXXXX												
cmdmodule	X													
dvm														
vhfmux														

Figure 27. HP V/382 Configuration Sequence (output of 'ivxisc or 'IVXISC')

Assigning Interrupt Lines

Hewlett-Packard's register-based modules are factory-set to interrupt line 1. This setting is selected on some modules by a finger-moveable jumper; on others the jumper is soldered onto the module.

When the Command Module is the resource manager, it assigns itself interrupt line 1 by default. Therefore, it is not necessary to move the jumpers on its HP register-based servants. However, in systems where the V/382 controller is the resource manager, the Command Module may be assigned line 2, 3, and so on. When line 1 is not assigned to the Command Module, you must either assign line 1, or move the jumpers on its register-based servants to the corresponding lines.

An Interrupt line can be assigned to the Command Module by modifying the "irq.cf" file used by the V/382 resource manager. The location of this file depends on the V/382 platform shown in the table below.

Platform	Location of file "irq.cf"
HP BASIC/UX	usr/pil/etc/vxi16/irq.cf
HP BASIC/WS	must be in the directory the resource manager executes from.

As an example, to assign interrupt line 1 to the Command Module:

1. Modify "irq" by adding the line shown in bold. The file listing on the next page is the HP BASIC/UX version of "irq.cf".
2. Re-save the file and re-boot the system (which re-runs the resource manager program). Re-run program "ivxisc" (or "IVXISC") and verify that the interrupt line has been assigned. The section "Interrupt Request Lines" in Figure 27 will show if the line has been assigned.

```
#  
# This database contains the mapping of VXI devices to interrupt lines.  
# Note that not all VXI devices need to use interrupt lines and that  
# not all interrupt lines need to be assigned. However, no interrupt  
# line that is allocated in this file can be allocated in the 'vmedevices'  
# file.  
#  
# The format of this files is as follows:  
#  
# line handler interruptors ...  
#  
# All fields are < tab> or < space> seperated. All values can be  
expressed in  
# decimal, or hex. The 'line' field is the interrupt line  
# being allocated. There can be at most one line for each interrupt  
# line. The handler field is the logical address of the interrupt handler  
# for this line (not that only one handler can be assigned for any  
# given line). The interruptors field is a list of logical addresses of  
# interrupters that can use this interrupt line.  
#  
1 2
```

In the bold line, interrupt line 1 is assigned to the Command Module at logical address 2.

Where To Go Next

Proceed to Step 8 - "Verify System Operation". This step enables you to verify that the HP-IB addresses are set as intended and that your controller is communicating with the system.

STEP 8: Verify System Operation

This step enables you to determine if the HP E1406/05 Command Module is communicating with an external controller or with an embedded controller.

Sending Commands

Instruments in the Series C mainframe are located by an HP-IB address. The HP-IB address is a combination of the controller's interface select code, the Command Module's primary HP-IB address, and the instrument's secondary HP-IB address. An address in this form in an HP BASIC statement appears as:

`OUTPUT 70903;"command..."`

Interface Select Code (7): Determined by the address of the HP-IB interface card in the controller. In most Hewlett-Packard controllers, this card has a factory-set address of 7.

Primary HP-IB Address (09): This is the address of the HP-IB port on the Command Module. Valid addresses are 0 to 30. The module has a factory-set address of 9.

Secondary HP-IB Address (03): This address is mapped from the logical address of the Instrument Identifier module by dividing the address by 8. Thus, for a logical address of 8, the secondary address is 01. For logical addresses of 16 and 24, the secondary addresses are 02 and 03, and so on.

The secondary HP-IB address of the HP E1406/05 Command Module is always 00 regardless of its logical address.

Embedded Controller and Message-Based Modules

In systems containing message-based modules which are servants to an embedded controller, the modules are programmed from the VXIbus backplane rather than from the HP-IB. The V/382 factory-set interface select code is 16. If necessary, refer to your embedded controller's documentation for the select code of the VXI interface board.

Since no secondary address is required as when programming from the HP-IB, the logical address of the message-based module is combined with the VXI interface select code.

For example, to program a message-based module with a logical address of 24, the OUTPUT statement in an HP BASIC program appears as:

`OUTPUT 1624;"..."`

for logical addresses from 1 to 99

or

OUTPUT 160155;"...

for logical addresses from 100 to 255

Refer to the controller's documentation for further information on the controller's input/output (I/O) operations.

SCPI Programming

Standard Commands for Programmable Instruments (SCPI) is an ASCII-based instrument command language designed for test and measurement instruments. The HP E1406/05 Command Module interprets the ASCII command strings for its register-based servant modules. Hewlett-Packard message-based modules have an on-board microprocessor which makes them capable of interpreting the command strings themselves.

SCPI Command Structure

SCPI commands are based on a hierarchical structure, also known as a tree system. In this system, associated commands are grouped together under a common node or root, thus, forming subtrees or subsystems. An example is the HP E1445A Arbitrary Function Generator's "ARM" subsystem.

ARM

```
:STARTl SEQuence[1]
  [:LAYer[1]
    :COUNt <number>
  :LAYer2
    :COUNt <number>
    [:IMMEDIATE]           [no query]
    :SLOPe <edge>
    :SOURce <source>

:SWEepl SEQuence3
  :COUNt <number>
  [:IMMEDIATE]           [no query]
  :LINK <link>
  :SOURce <source>
```

ARM is the root keyword of the command, :STARTl SEQuence1 and :SWEepl SEQuence3 are second level keywords, :LAYer1 and :LAYer2 are third level keywords, and so on. A colon (:) always separates a command keyword from a lower level keyword as shown on the following page.

ARM:LAY2:SOUR EXT

A semicolon (:) is used to separate two commands within the same subsystem, and can also save typing. For example, sending this command message:

ARM:LAY2:SOUR EXT;SLOP POS;COUN 10

is the same as sending these three commands:

ARM:LAY2:SOUR EXT

ARM:LAY2:SLOP POS

ARM:LAY2:COUN 10

Note that the semicolon (:) and colon (:) link commands within different subsystems. Only a semicolon (:) is required to link commands within the same subsystem.

Terminating Commands

A SCPI command string is terminated with a line feed (LF) or with an End Of Identify (EOI) message. The carriage return (CR) is ignored.

Verification Program

The following HP BASIC program uses the Command Module's VXI:CONFigure:DLISt? command to verify the system configuration. The program assumes the configuration indicated in Figure 26 (page 46). The controller commands used are for an external Hewlett-Packard Series 300 controller or for an embedded controller using the HP BASIC language.

NOTE

This program prints only a portion of the data returned by the DLISt? command. Complete information on the command can be found in the Command Module User's Manual.

```

1 !Dimension a computer variable to store module information from
2 !the 26 mainframe slots. Dimension a variable for the 26 possible
3 !logical addresses.
10 DIM Dlis$[1000]
20 DIM Laddr(26)
25 !Clear the screen. Assign an I/O path to the Command Module.
30 CLEAR SCREEN
40 ASSIGN @E1406 TO 70900;EOL CHR$(10) END
41 !Query the Command Module to determine the number of logical
42 !addresses in the mainframes. Re-dimension the logical address
43 !variable.
50 OUTPUT @E1406;"VXI:CONF:DNUM?"
60 ENTER @E1406;Num
70 REDIM Laddr(1:Num)
75 !Read all of the logical addresses in the mainframes.
80 OUTPUT @E1406;"VXI:CONF:DLAD?"
90 ENTER @E1406;Laddr(*)
91 !Send the DLIS? command to each logical address (module) in the
92 !mainframes. Separate the data returned by DLIS? into individual
93 !variables.
100 FOR I= 1 TO Num
110 OUTPUT @E1406;"VXI:CONF:DLIS? "&VAL$(Laddr(I))
120 IMAGE K,K,K,K,K,3A,X,4A,X,10A,X,10A,X,5A,X,3(AA,X),K
130 ENTER @E1406 USING 120;N1,N2,N3,N4,N5,N6,C1$,C2$,C3$,
C4$,C5$,S1$,S2$,S3$,Dlis$
131 !Print the module's logical address, its commander's logical address,
132 !the slot where it is installed, its PASS/FAILED/READY status, and
133 !the manufacturer's comments about the module.
140 IMAGE 6(K,2X),3A,2X,4A,2X,10A,2X,5A,/3(2A,2X),K,2/
150 PRINT USING 140;N1,N2,N5,C5$,Dlis$
160 NEXT I
170 END

```

Comments

1. A listing of the data returned is shown below:

0	-1	0	READY	"SYSTEM INSTALLED AT SECONDARY ADDR 0"
1	-1	1	READY	"VXIbus EXTENDER INSTALLED AT LADD 1"
24	0	6	READY	"VOLTMTR INSTALLED AT SECONDARY ADDR 3"
128	0	5	READY	"SWITCH INSTALLED AT SECONDARY ADDR 16"
129	-1	0	READY	"VXIbus EXTENDER INSTALLED AT LADD 129"
136	0	9	READY	"MBinstr INSTALLED AT SECONDARY ADDR 17"
240	0	-1	READY	"IBASIC INSTALLED AT SECONDARY ADDR 30"

From this data, notice the following:

- For each listing, the first number is the module's logical address, the second number is the logical address of the module's commander, the third number is the mainframe slot the module is installed in (IBASIC does not have a slot). The comments describe the module.
- In this system, the Command Module (logical address 0) is the commander of each device except itself and the VXIbus extender modules (-1).

STEP 9: Read and Set the Time and Date

Example: Reading the Time

Using Standard Commands for Programmable Instruments (SCPI) commands, the following program reads and prints the time from the Command Module's internal clock. The controller commands used are for an HP Series 300 controller (external or embedded) running HP BASIC.

```
1 !Reset the Command Module.  
10 OUTPUT 70900;"*RST"  
15 !Read the time.  
20 OUTPUT 70900;"SYST:TIME?"  
25 !Place hour in H, minutes in M, seconds in S.  
30 ENTER 70900; H,M,S  
35 !Print the time.  
40 PRINT H,M,S  
50 END
```

Typical response: 16 15 30 (4:15:30 PM)

Example: Setting the Time

The following line sets the time to 14,00,00 (i.e., 2:00:00 PM).

```
OUTPUT 70900;"SYST:TIME 14,00,00"
```

Example: Reading the Date

Using SCPI commands, the following program reads and prints the date stored in the Command Module's internal calendar. The controller commands used are for an HP Series 300 controller (external or embedded) running HP BASIC.

```
1 !Read the date.  
10 OUTPUT 70900;"SYST:DATE?"  
15 !Place year in Y, month in M, day in D.  
20 ENTER 70900; Y,M,D  
25 !Print the date.  
30 PRINT Y,M,D  
40 END
```

Typical response: 1992 5 12 (May 12, 1992)

Example: Setting the Date

Using the *YYYY,MM,DD* format, the following line sets the date to 1992, 5, 12 (May 12, 1992).

```
OUTPUT 70900;"SYST:DATE 1992,05,12"
```

NOTE

More information on the Command Module's TIME and DATE commands can be found in the Command Module user's manual

Configuration and Start-up Errors

The Command Module error messages associated with system installation and configuration are shown on the following pages. These messages are displayed if a terminal or printer is connected to the Command Module's RS-232 port. If a terminal or printer is not used, the messages can be read from the system instrument error queue, using SYST:ERR?. An example using SYST:ERR? is shown below:

```
DIM Err_msg$[256]
REPEAT
    OUTPUT 70900;"SYST:ERR?"
    ENTER 70900;Code,Err_msg$
    PRINT Code,Err_msg$
UNTIL Code= 0
```

NOTE

Error codes read from the error queue are preceded by the number 21. For example, error code 11 displayed on a monitor would appear as 2111 if read from the error queue instead.

NOTE

If a fatal error has occurred and the system instrument is not started, SYST:ERR? cannot be used to read the error queue.

Table 5. Command Module Resource Manager Configuration Errors

Error	Message	Cause
1	FAILED DEVICE	A device failed its power-on self-test. A device is failed if the resource manager finds the PASSED bit false. The test is done five seconds after power-on, or when the operating system has determined that *SYSFAIL is not asserted.
2	UNABLE TO COMBINE DEVICE	A device cannot be combined as part of a virtual instrument.
WARNING	DEVICE DRIVER NOT FOUND	A device's VXI driver is not in the Command Module. The resource manager expects to find a driver for all register-based or message-based devices that are not I or I4. The devices can still be accessed through their registers.
4	DC DEVICE ADDRESS BLOCK TOO BIG	The block of addresses required to dynamically configure devices is greater than 127. The VXI specification allows blocks larger than 127. However, due to the VXI specification restrictions on where DC blocks can be located, the resource manager rejects blocks larger than 127 since these blocks would have to start at either 0 which is used by the resource manager, or use address 255 which disables dynamic configuration.
5	A24 MEMORY OVERFLOW	There is not enough available A24 memory required for a device. The allowable memory space is from 200000h to FFFFFFFh (E00000h - FFFFFFFh is only used if there is an 8 Mbyte device in the system). If your system has (mainframe) extenders, try using the user-defined extender table to allocate the memory more efficiently.
6	A32 MEMORY OVERFLOW	There is not enough available A32 memory required for a device. The allowable memory space is from 20000000h to FFFFFFFFh (E0000000h - FFFFFFFFh is only used if there is a 2000 Mbyte device in the system). If your system has (mainframe) extenders, try using the user-defined extender table to allocate the memory more efficiently.
7	DC DEVICE MOVE FAILED	A dynamically configured device did not move to its new logical address. After setting a DC device (or a block of devices), the resource manager checks the new address(es) to see if the device(s) actually moved.
8	INACCESSIBLE A24 MEMORY	An A24 device has memory below 200000h or above DFFFFFFh. The Command Module cannot access this memory.
9	UNABLE TO MOVE DC DEVICE	There is no logical address (or address block) available for a dynamically configured device to move to. Try using a user-defined dynamic configuration table or the user-defined extender table to assign the addresses more efficiently.
10	INSUFFICIENT SYSTEM MEMORY	Too many instruments are installed for the amount of RAM available in the Command Module. Only the system instrument is started.
11	INVALID INSTRUMENT ADDRESS	A module's logical address is not a multiple of 8, or is not part of a virtual instrument. Secondary HP-IB addresses are only given to devices with logical addresses that are multiples of eight.

Table 5. Command Module Resource Manager Configuration Errors (Cont'd)

Error	Message	Cause
12	INVALID UDEF COMMANDER LADD	The user-defined commander logical address is not a valid commander. Either the commander does not exist, or it is not a message-based commander.
14	INVALID UDEF SECONDARY ADDRESS	Invalid user-defined secondary address specified in the commander/servant hierarchy table. The secondary address specified was not 0 - 30, the address was 0 which is the Command Module address, or the module is not in the servant area of the Command Module.
15	DUPLICATE SECONDARY ADDRESS	The same secondary address was specified for more than one module in the user-defined commander/servant hierarchy table.
16	INVALID SERVANT AREA	The servant area of a commander is greater than 255, or the servant area of a servant module is greater than that of its commander. An invalid servant area is truncated to an allowable range and system configuration continues.
17	SLOT 0 FUNCTIONS DISABLED	The Command Module is installed in slot 0 and its Slot 0 and System Controller switches are set to 'Disable'.
18	INVALID COMMANDER LADD	The commander specified in the user-defined commander/servant hierarchy table is not a valid message-based commander, or the device does not exist.
19	BNO FAILED	BNO was issued to a message-based device whose response indicated an error condition. The Begin Normal Operation command may have failed or the device returned a response other than FFFEh. (See the VXI specification for a description of the BNO response.)
20	WRITE READY TIMEOUT	The Command Module timed out waiting for write ready to be asserted by a message-based device. The Command Module/resource manager was attempting to send a word serial command to a message-based device but write ready was not asserted on the device within 60 seconds. This can occur either before or after the command was sent. If before, the Command Module timed out without sending the command. If after, the Command Module timed out while determining if ERR* was asserted by the message-based device.
21	READ READY TIMEOUT	The Command Module timed out waiting for read ready to be asserted by a message-based device. The Command Module was attempting to read the response to a message-based query command, but read ready was not asserted on the device within 60 seconds.
22	ERR* ASSERTED	A word serial protocol error occurred. The Command Module/resource manager detected a word serial protocol violation due to a word serial command. The Command Module checks for ERR* asserted before and after sending a word serial command to a message-based device. If ERR* is asserted before, the command is not sent. This error also occurs if the Command Module is not the resource manager and it receives a word serial command it does not recognize.
23	ENO FAILED	ENO was issued to a message-based device whose response indicated an error condition. Proper ending of normal operation is the response FFFEh.

Table 5. Command Module Resource Manager Configuration Errors (Cont'd)

Error	Message	Cause
24	INTERRUPT LINE UNAVAILABLE	The interrupt line assigned by the user-defined interrupt line table is not available. Either the line has been assigned or has been reserved. This error also occurs if the line being assigned to an interrupter is not handled by the interrupter's commander.
25	INVALID UDEF HANDLER	A user-defined interrupt handler specified in the interrupt line allocation table is invalid. The handler logical address may not be valid, the device may not be a programmable handler, or the device has been assigned as many lines as it can handle.
26	INVALID UDEF INTERRUPTER	A user-defined interrupter specified in the interrupt line allocation table is not a valid interrupter. The interrupter logical address may not be valid, the device may not be a programmable interrupter, or the device has been assigned as many lines as it can interrupt on.
WARNING	DIAGNOSTIC MODE ON	The diagnostic switch on the Command Module is set to '1'. Only the system instrument is started. No other modules receive BNO.
WARNING	RESOURCE MANAGER NOT IN SLOT 0	The Command Module is the resource manager (logical address = 0) but is not installed in slot 0. The Command Module will configure the system but will not do dynamic configuration.
WARNING	SYSFAIL DETECTED	SYSFAIL occurred during operation. The resource manager re-boots.
30	PSEUDO INSTRUMENT LADD UNAVAILABLE	The logical address requested by a pseudo instrument (e.g. IBASIC) is already in use. Pseudo devices request a particular logical address. This error occurs if the logical address is used by a static or dynamically configured device.
31	FILE SYSTEM START UP FAILED	There is not enough memory in the Command Module to set up the file system required for IBASIC.
32	INACCESSIBLE A32 MEMORY	An A32 device has memory below 20000000 or above DFFFFFFF. The Command Module can assign, but cannot access A32 memory.
33	INVALID UDEF MEMORY BLOCK	The base address specified in the A24/A32 address allocation table is invalid, or the address block exceeds FFFFFFFh in A24 memory.
34	UDEF MEMORY BLOCK UNAVAILABLE	The memory block specified in the A24/A32 address allocation table has already been assigned. Also, in a system with VXI-MXI VXIbus extenders, A24/A32 window restrictions may force some addresses to unavailable on a given VMEbus.
35	INVALID UDEF ADDRESS SPACE	An invalid A24/A32 address space specifier was used in the A24/A32 address allocation table.
36	DUPLICATE UDEF MEMORY LADD	A logical address is specified more than once in the same A24/A32 address allocation table.
37	INVALID UDEF CNFG TABLE	The valid flag in the user-defined commander/servant hierarchy table is not true (1). VXI:CONF:CTAB <address> has been set but is pointing to an invalid table. Either the table is corrupt or has not been downloaded.

Table 5. Command Module Resource Manager Configuration Errors (Cont'd)

Error	Message	Cause
38	INVALID UDEF CNFG TABLE DATA	There are 0, or greater than 254 entries in the user-defined commander/servant hierarchy table.
39	INVALID UDEF DC TABLE	The valid flag in the user-defined dynamic configuration table is not true (1). VXI:CONF:DCT <address> has been set but is pointing to an invalid table. Either the table is corrupt or has not been downloaded.
40	INVALID UDEF DC TABLE DATA	There are 0, or greater than 254 entries in the user-defined dynamic configuration table.
41	INVALID UDEF INTR TABLE	The valid flag in the user-defined interrupt line allocation table is not true (1). VXI:CONF:ITAB <address> has been set but is pointing to an invalid table. Either the table is corrupt or has not been downloaded.
42	INVALID UDEF INTR TABLE DATA	The interrupt line allocation table has invalid data. The number of records is less than 1 or greater than 7, the interrupt line specified is less than 1 or greater than 7, or the number of interrupters or handler ID is less than 1 or greater than 254.
43	INVALID UDEF MEM TABLE	The valid flag in the user-defined A24/A32 address allocation table is not true (1). VXI:CONF:MTAB <address> has been set but is pointing to an invalid table. Either the table is corrupt or has not been downloaded.
44	INVALID UDEF MEM TABLE DATA	An invalid logical address was specified in the A24/A32 address allocation table. The logical address range is 0 to 255 or -1.
WARNING	NVRAM CONTENTS LOST	System non-volatile memory was cleared during a re-boot. DIAG:BOOT:COLD was executed or the memory had a invalid checksum.
46	MESG BASED OPEN ACCESS FAILED	IBASIC or HP-IB access to a message-based device failed because of a device failure. The resource manager tries to open a paths between the HP-IB port and/or IBASIC and message-based devices (I and I4) using word serial commands. The device either failed to respond, or the device violates the VXI word serial protocol specification.
47	GRANTED DEVICE NOT FOUND	The Command Module, when not the resource manager, was granted a device that does not exist.
WARNING	DRAM CONTENTS LOST	Downloaded driver non-volatile memory was cleared during a re-boot. DIAG:BOOT:COLD was executed or the memory had a invalid checksum.
49	VME SYSTEM CONTROLLER DISABLED	The System Controller switch on the Command Module is set to the 'Disable' position.
50	EXTENDER NOT SLOT 0 DEVICE	A VXI-MXI mainframe extender module is not in slot 0 of its (remote) mainframe.
51	INVALID EXTENDER LADD WINDOW	Modules do not fit in the logical address window set by the user-defined extender table. Not all of the devices found "below" an extender will fit into the largest available window for that extender. Either reset the logical addresses or use the extender table to override the default algorithm.

Table 5. Command Module Resource Manager Configuration Errors (Cont'd)

Error	Message	Cause
52	DEVICE OUTSIDE OF LADD WINDOW	A module in a (extender) mainframe is outside of the logical address window set by the resource manager or set by the user-defined extender table. Either reset the logical addresses or download a new extender table.
53	INVALID EXTENDER A24 WINDOW	The resource manager found an invalid start address or size for an extender A24 address window. Either reconfigure the VME memory devices or use the extender table.
54	DEVICE OUTSIDE OF A24 WINDOW	A module with A24 memory is located outside of the extender logical address window. Either reconfigure the VME memory devices or use the extender table.
55	INVALID EXTENDER A32 WINDOW	The resource manager found an invalid start address or size for an extender A32 address window. Either reconfigure the VME memory devices or use the extender table.
56	DEVICE OUTSIDE OF A32 WINDOW	A module with A32 memory is located outside of the extender logical address window. Either reconfigure the VME memory devices or use the extender table.
57	INVALID UDEF LADD WINDOW	A user-defined logical address window violates the VXI-6 specification (has an invalid base or size).
58	INVALID UDEF A16 WINDOW	A user-defined A16 window violates the VXI-6 specification (has an invalid base or size).
59	INVALID UDEF A24 WINDOW	A user-defined A24 window violates the VXI-6 specification (has an invalid base or size).
60	INVALID UDEF A32 WINDOW	A user-defined A32 window violates the VXI-6 specification (has an invalid base or size).
61	INVALID UDEF EXT TABLE	The valid flag in the user-defined extender table is not true (1). The valid flag must be set to '1' or the table is assumed to be invalid. To disable the table without re-booting, set the table address to '0' using VXI:CONF:ETAB 0.
62	INVALID UDEF EXT TABLE DATA	There are an invalid number of records in the user-defined extender table. The number of records must be a number between 1 and 254.
63	UNSUPPORTED UDEF TTL TRIGGER	There is a user-defined extender table TTL trigger entry for a VXI-MXI extender that does not support TTL triggers.
64	UNSUPPORTED UDEF ECL TRIGGER	There is a user-defined extender table ECL trigger entry for a VXI-MXI extender that does not support ECL triggers.
65	DEVICE NOT IN CONFIGURE STATE	A message-based device was not in the CONFIGURE state during a re-boot. The *SYSRESET should propagate to all mainframes through the INTX cables. Check the INTX connectors on remote mainframes.
66	INTX CARD NOT INSTALLED	INTX daughter card is not installed on the VXI-MXI extender module. The resource manager expects the INTX card to be installed in order for *SYSRESET and interrupts to propagate throughout the system.
WARNING	FLASH ROM DRIVER CONTENTS LOST	Downloaded instrument drivers stored in the flash ROM are not available for use by the resource manager. Erase and reprogram the driver portion of the flash ROM.

Checking for Instrument Errors

The following HP BASIC program is a method of checking for errors as you program the instruments (plug-in modules) in your VXIbus system. The program monitors the instrument's Standard Event Status Register for error conditions. If no errors occur, the instrument functions as programmed. If errors are detected, the instrument interrupts the controller. The controller reads the error codes and messages from the instrument's error queue and displays them. In this program, the instrument (multimeter) at secondary HP-IB address 03 (logical address 24) is monitored. The controller commands used are for an HP Series 300 controller (external or an embedded controller) running the HP BASIC language.

NOTE

If an RS-232 display terminal is used, typing:

SYST:ERR?

at the VOLTMTR_24: prompt reads and displays the error messages from the multimeter's error queue.

```
1 !Call controller subprogram "Errmsg" when a programming error occurs.
2 !Enable the controller to respond to an interrupt from the instrument.
10 ON INTR 7 CALL Errmsg
20 ENABLE INTR 7;2
21 !Unmask the Event Status bit in the instrument's Status Byte register.
22 !Unmask error conditions in instrument's Standard Event Status Register.
30 OUTPUT 70903;** SRE 32"
40 OUTPUT 70903;** ESE 60"
41 !Program the instrument for the application
50 OUTPUT 70903;"...
60 OUTPUT 70903;"...
70 OUTPUT 70903;"...
71 !Allow the controller to respond if an error occurs.
80 WAIT 2
90 END
91 !When an error occurs, clear the instrument to regain control. Execute a
92 !serial poll to clear the service request bit in the Status Byte register.
93 !Read all error messages in the instrument's error queue. Clear all bits in
94 !the instrument's Standard Event Status register.
100 SUB Errmsg
110 DIM Message$[256]
120 CLEAR 70903
130 B= SPOLL 70903
140 REPEAT
150 OUTPUT 70903;"SYST:ERR?"
160 ENTER 70903;Code,Message$
170 PRINT Code,Message$
180 UNTIL Code= 0
190 OUTPUT 70903;** CLS"
200 STOP
210SUBEND
```

NOTE

For information on an instrument's Status Byte and Standard Event Status registers, refer to the HP E1406 Command Module User's Manual or the "Beginner's Guide to SCPI" (Hewlett-Packard part number H2325-90001).

Where To Go Next

- To find additional information on the HP E1406/05 Command Module:

HP E1406A Command Module User's Manual (E1406-9000x)

- To find operating and programming information on Hewlett-Packard plug-in modules:

Refer to the manual that came with the module (E14xx-9000x or (E13xx-9000x))

- To find information on the Standard Commands for Programmable Instruments language (SCPI):

Beginner's Guide to SCPI (H2325-90001)



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